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NATIONAL MUSEUM OF VICTORIA

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The Journal of the Department of Agriculture of Victoria, Australia.

October, 1921.

PRINCIPAL CONTENTS

The Discovery of Agriculture

Minyip Crop and Fallow Competition

Calf Rearing Lucerne Experiments

Peach Growing

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THE JOURNAL

OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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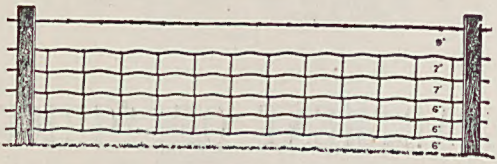

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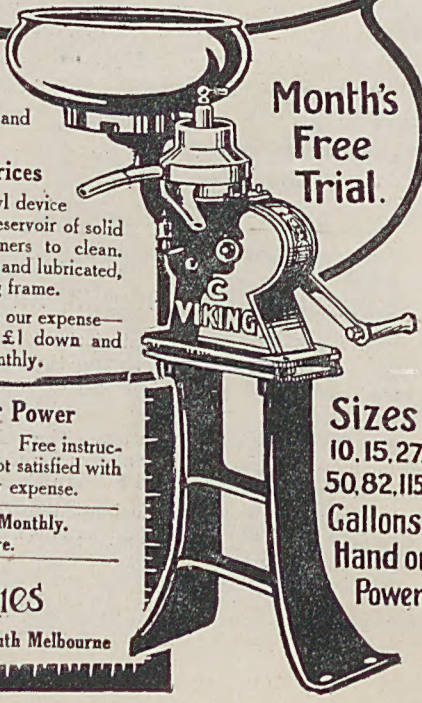

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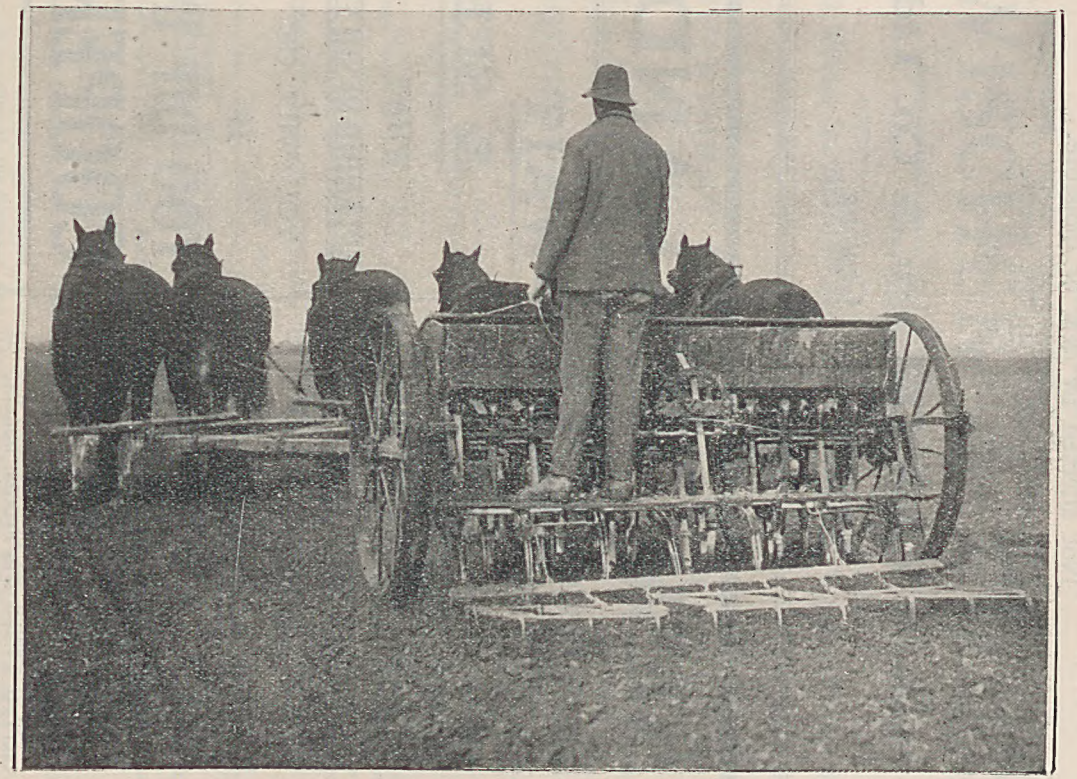

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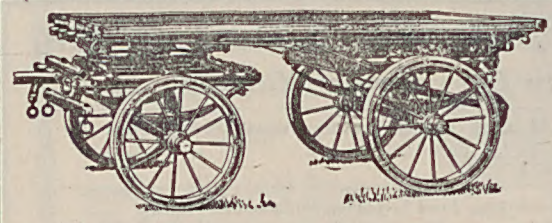

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Vol. XIX. October, 1921. Part 10.

THE DISCOVERY OF AGRICULTURE.*

By Thomas Cherry, M.D., M.S.

The usual theory in regard to the origin of agriculture is thus set out by Breasted:—"For thousands of years the women of those early ages had gathered the seeds of wild grasses to be crushed between two stones and made into rude cakes. They now gradually learned that the growth of such wild grasses might be artificially aided. From such beginnings it was but a step to drop the seed into the soil at the proper season, to cultivate it, and to harvest the yield."† Such a theory has been deduced from the habits of tribes who at the present day are in the lower stages of culture; two great assumptions being made: that the prehistoric ancestors of all mankind have followed the one path, and that small seeded grasses have been cultivated into barley and wheat. But an entirely new light has been thrown on the question by recent work in Egypt. The discovery has been made of the actual food-stuffs used by these people at the very dawn of civilization. And, as we shall see, the question is thus raised whether the art of cultivation, wherever it may now be practised, has not been derived from this single source. We start from the following foundation fact:—"From the stomachs and intestines of the [earliest known inhabitants of Egypt] I was able to recover large quantities of food materials, in fact, the last meal eaten before death. . . . Almost every sample contained husks of barley, and in about 10 per cent. husks of millet could be identified with certainty. . . . Root tubers of *Cyperus esculentus* (the nut rush) were found both in the intestinal contents and in pots placed in the graves alongside the bodies. These tubers were of very small size, which Dr. Netolitzky regards as evidence of either the

* Paper read at the Australian Association for the Advancement of Science Congress, Melbourne January, 1921.

† Ancient Times, 1916, p. 22.

utilization of the wild plant or the beginning of its cultivation."* The accident that the first Egyptians buried their dead in the dry hot sand of the desert led to the desiccation of the body and its contents, and this before putrefaction had far advanced, so that the nature of their usual diet is thus placed beyond dispute. It will make the drift of our argument all the more definite if the date of these sand-dried bodies can be fixed. Breasted places the discovery of metal, of writing, and of all the arts and crafts of civilization in the thousand years from 4000 to 3000 B.C.† All recent work tends to confirm 3400 as the approximate date of the First Dynasty, and forthwith progress was accelerated. "These four centuries (3400 to 3000) witnessed the development of Egyptian civilization out of comparative barbarism."‡ It becomes increasingly difficult to stretch the record on the Euphrates beyond 3000, the history of China beyond 2000, and that of India beyond 1000 B.C.

The next indication of the use of the cereals is a charred fragment of ivory found in a First Dynasty grave. This has an ear of conventional design engraved on it. The long beard makes this drawing equally suitable for either barley or bearded wheat. Next, at about the year 2900 B.C., one of the earliest scraps of literature relates how four goddesses came to Heliopolis to superintend the birth of the triplet sons of the lady Rud-dedit, the first of the children of the sun god. After consultation with her husband, the high priest, she gave the nurses a bushel of barley as a thankoffering. A few weeks later the happy mother wished to brew beer to make a feast, and it was found that this bushel was all the grain there was in the temple. In contrast with this dearth we find "heaps of wheat" a common royal gift to the temples some 700 years later, and barley now seems to have become less thought of than wheat. The following references are also found at about the epoch 2000 B.C. In the tale of the *Sekhti and Hemti* the husbandman is said to have had wheat and barley growing on his farm in the Fayum; and both cereals are mentioned by *Senuhi* amongst the products of the South of Palestine. The biblical references to the corn of Abraham and Isaac at Beersheba are perhaps a century later.

Passing to Mesopotamia, flint sickles have been found in the lowest strata of remains at Susa and other early sites, including Anau to the east of the Caspian. The straw of *Triticum monococcum* occurs in mud bricks from the Euphrates, and also from the second city of Troy. A few impressions of the ears of ordinary wheat and barley have also been identified. The sickles are of the same shape and make as those found in Egypt, and it is not probable that any of this Asiatic material goes back to the year 3400 B.C. As we shall see, there are good grounds for believing that agriculture was the special gift of the Nile, and that it was introduced into Asia from Egypt.

Coming down to much more recent times, the widespread belief amongst all European peoples was that the cereals came from the East. The word for barley is very similar in many Indo-European languages, while wheat has different and unrelated names. Hence it is probable

* G. Elliot Smith, "The Ancient Egyptians," 1911, p. 41.
† *Loc cit.* pp. 54, 55.
‡ Hall, Ancient History of Near East, 1912, p. 115.

that these people knew barley before they knew wheat. But it is doubtful if any of the evidences of agriculture found with the neolithic implements in European lake dwellings, kitchen middens, and tumuli are of very great antiquity. In the case of the Swiss Lake dwellings, wheat, barley, millet, flax, copper, and perforated stone axes are all found together. The grains of millet, barley, and wheat are all very similar in appearance to those of any average crop in Australia. The presence of millet goes far towards solving the mystery of these settlements. Millet is not now grown in Switzerland, although it is on the plains of Italy. But these plains are nearly at sea-level, while the Swiss lake is at an elevation of 1,500 feet. The experience of failure in an average year in the mountain valleys has made the Swiss abandon millet and pin their faith to the cereals. Probably a generation or two would be sufficient to teach the pioneers that the risk of frost was too great to allow of millet becoming a staple crop. As millet, therefore, was clearly not an indigenous product of the country, it must have been brought from abroad. Breasted traces copper blades from Egypt, through the Mediterranean area, to Denmark* The baked-clay spinning whorls, with flax attached, also recall Egypt. On grounds which need not detain us here, the probable date of the European lake dwellings and megalithic monuments is not earlier than 2000 B.C., and most of them may be nearly 1,000 years later.

Now, while at first sight it would appear to be highly improbable that man began agriculture as an irrigator, it is nevertheless the fact that the first traces of civilization are found in two rainless regions, Egypt and Sumeria. With the recent laying bare of the foundations of history as distinguished from tradition, it seems certain that the Egyptian civilization was evolved in the valley of the Nile, and equally certain that the Babylonian civilization was imported. In Egypt, every phase may be followed, from absolute barbarism to the highest culture, and this without a break. It is idle, therefore, to turn to some hypothetical land and assume that the Egyptians, as emigrants, brought the knowledge of agriculture with them, and adapted this knowledge to irrigation in order to meet the new conditions of the Nile. Nor is it probable that man cultivated the vine and olive first, and subsequently extended his care to the cereals. As a matter of fact, the two oldest civilizations—Egypt and Babylon—depended entirely on irrigation, while the second group, which clustered round these—Elam, Assyria, Persia, Phœnicia, and Syra—were all noted for their skill in irrigation. The earliest known Indo-Europeans—the Kassites and Mitanni—appear to have had no culture. It may also be more than a coincidence that the Hittites arose on the edge of the salt treeless tract in Central Asia Minor. In this district irrigation for summer crops is now practised, so that the Hittites may also have been acquainted with the art.

In the history of the race there is a mystery which appears to be insoluble unless we assume that the Egyptians were in reality the first of mankind to use the cereals. It may be stated as follows:—The population of the world was practically stationary in numbers throughout the many thousand years of the old stone ages. But with the coming

* Ancient Times, p. 223.

of the Egyptians at the epoch 4000 B.C. this stagnation passed away, and mankind has been steadily increasing in numbers ever since. The Chinese, for instance, have doubled during the historic period at least once in each 250 years. The proof that prehistoric man remained nearly stationary is the simple fact that if his numbers had doubled only once in a thousand years there would have been a population of a thousand millions in 30,000 years. Now 30,000 is a low estimate of the duration of the old stone ages. Even if it be urged that the bones of the prehistoric man may have decayed, this explanation will not account for the absence of stone chips and implements. On some of the wind-swept river plains in the dry parts of Australia the only stones are those which have been brought by man in his wallet or by birds in their gizzards. Such relics do not decay, nor are they blown or washed away. In the course of thousands of years they would become very numerous if the numbers of aborigines or of emus had ever been very great, just as scraps of pottery are abundant at Memphis. Absence of remains is, therefore, a sure indication that the population was small until progress began on the banks of the Nile. That is, in some way there has been a complete break in the conditions of life as represented by the times before and after the dawn in Egypt. The exploitation of the metals is often spoken of as the origin of our civilization—"The age of metals." But it may be that the true explanation of the change is the use of the cereals as foodstuffs, for gold and copper were used as ornaments for ages before they were fashioned into articles of utility. The *rôle* of the cereals may be explained as follows:—

In the early stages of his career, man probably lived for the most part on food of animal origin, the wild fruits and roots contributing only a small percentage of the total supply. Comparative anatomy and physiology suggest that man was not evolved as a vegetable feeder, for the structure of his alimentary canal and its length in proportion to that of the body is much nearer to the ratio found in some of the carnivora than to that which is characteristic of the herbivora. Primitive man probably lived near the seashore, and by the sides of the great rivers, where he could get shell fish as well as the vertebrates for food. But the extent to which berries, acorns, and nuts were used was probably never very great. If one is reminded of the coconut and banana, it must be remembered that civilization did not begin in places where these grow wild. In former ages people did not preserve the surplus food from times of plenty to meet the deficiency in times of scarcity. They were always near the edge of want, because the family was dependent from day to day on the results of the day's work. The coming and going of bird, fish, and beast cannot be controlled by man.

A few years ago, when a whale came ashore in Australia, signal smokes were made and intertribal restrictions suspended, so that all might have a share of the feast. But long before the carcass was eaten it became too far decayed, and the few days of surfeit were followed by the usual short rations. It is even doubtful whether man domesticated any animal except the dog until he had become an irrigator on the banks of the Nile. The small groups of hunters living far back in the grass

lands may never have learnt the special value of milk, nor have had the idea of trying to improve their food supply by taming the ox or goat. Their grass lands have always been subject to low rainfall and years of drought, or otherwise they would have been covered with forests, so that the population was kept small by the exigencies of the rainfall alone. At all events, we are able to say for certain that there was no overflow of population from the grass lands until more than a thousand years after the increase had become marked in Egypt. At the close of the ice ages, man *might* have devised frozen storage for meat, or he might have grown numerous by the use of smoked meat with rice or maize. But he did none of these things, for the recent discoveries in Egypt show that the way the food supply was made secure throughout the year was by the use of barley and millet.

Next, as to the origin of irrigated agriculture. If we assume for the moment that these two plants were found growing wild, the art of cultivation may have been learnt in Egypt from the simple experiment of imitating on one part of the flood plain what was done naturally by the river a few miles away. Throughout all the area of the valley under flood there are unique features *which are not found elsewhere in the world.* The most important of these is the seasonal incidence of the floods. The plain is soaked at the very end of the hot season, so that the land remains moist for several months, because it is then the cool season and evaporation is small compared with what it would have been if the flood had come at the beginning of summer. The slope of the plain is such that very large areas are soon clear of the water, and stagnant swamps are not a great feature of the valley. At the same time, the temperature in the cool season is high enough to keep millet, barley, wheat, and flax steadily growing until the opening of the following summer.

The Nile is unique, not only in flowing from the tropics into a much cooler zone, but in having a double source of water supply. The equatorial source, gathering in the Great Lakes and the other branches of the White Nile, keeps up a regular daily flow of 50,000,000 cubic yards at Khartoum. The same quantity issues from Lake Victoria, so that the great tributaries are just sufficient to make good the loss by evaporation during the first 1,200 miles of its course. It is joined in Nubia by the Blue Nile and Atbara from Abyssinia, which carry little water during most of the year but are subject to immense floods in August and September. The volume of water may reach 1,000,000,000 cubic yards a day. The natural flood is, therefore, an inundation lasting only a few weeks. The cool part of the year is from October to March. This natural cycle of flood and cool weather exactly suits the seasonal growth of millet and barley, and probably it was here that the cultivated varieties of these plants completed the last stages of their evolution long before man came down the valley. They appear above the ground a few days after the water drains off, and ripen at the beginning of the hot season, before the soil is parched by the oncoming summer. The seeds lie on the surface of the land without injury until next flood season, when it is again soaked and the cycle begins anew.

In some of the irrigation districts in Australia, barley may be grown with no other moisture beyond that of a single heavy flooding at the beginning of winter, and some varieties of millet ripen in less than

three months of the time of planting. If we suppose that the Egyptians gathered the wild seeds and discovered that they could be preserved from year to year simply by keeping them dry, we have discovered a reason to account for their population beginning to increase in number. The fact that Egypt is a rainless land makes it easy for the seed to lie on the surface of the ground, or buried a few inches, without losing its power of germination. The same dry atmosphere makes it easy to store the grain without its being injured by mildew or weevils, the two pests which make it very difficult to carry on from one harvest to the next in all the moist regions of the tropics. Such continuous losses from these and other causes are experienced by even the most up-to-date of European planters, that, were it not for very cheap labour, no tropical colony could be made an economic success. In the face of these difficulties it is very unlikely that primitive man ever discovered the secrets of agriculture without outside assistance in the tropics.

With the wild plants, the soil, the time of the floods, and rainless climate all favorable, it would have been easy for man to learn the art of agriculture in Egypt, when nature was annually pointing the way so clearly. This probably began by scraping a shallow channel here and there through a flat ridge, and so inviting the water to reach the higher parts of the plain more promptly, and after a few weeks to drain off more rapidly. Experience would soon lead to the closing or deepening of these first channels at given periods, and so the first steps towards "basin irrigation" would be made. In basin irrigation the flood water is led in this way from the first to a number of other level areas in succession, the necessary works in the shape of channels and banks being small affairs. The surface of the flood plain needed no levelling or adjustment to prepare the way for effective irrigation; and the tops of the banks have become the pathways from village to village.

Working the land by means of a stick or hoe may have resulted from the observation that where the mud was well marked by the footprints of wild animals, the crop in the following year was more luxuriant than the average. The tomb pictures at Sakkara show pigs and sheep treading in the seed, and the following hint from Herodotus may suggest that cultivation began by imitation:—"When the river has come of its own accord and irrigated their fields, and having irrigated them has subsided, then each man sows his own land and turns swine into it, and when the seed has been trodden in by the swine he waits for the harvest." (*Herodotus*, II., 14.) To imitate the hoof prints by means of a stick would be an easy matter, and if some tradition about the connexion between swine and a good harvest had come down the ages, it may have given rise to the strange idea of the pig being regularly thought of as part of the fertility of the land, and becoming sacred to the Great Mother—"The pig the surrogate of the cowry."

The first steps towards agriculture were thus very simple ones in some parts, at least, of the Nile valley. Subsequently larger banks would be made and channels dug to control the water, and by the primitive shadouf the water could be lifted from the river or channel in order to help the crops in parts which appeared to be too dry.

Irrigation was thus made perennial by a simple and natural course of development, and that this was the real order of events is confirmed,

as I show in another paper,* by the earliest beliefs of the Egyptian people—the thoughts which became the foundation of their mythology. An obvious scientific explanation is forthcoming if we assume that the order of events was—First, the use of wild millet and barley and the gathering and storing of the seeds. Second, the use of sticks to till the land, combined with simple improvements in the way the water flooded and ran off the land; that is, copying the natural basin irrigation. Third, transforming backwaters and lagoons into canals from which the water was lifted into small channels by the shadouf.

The conditions which have always existed in Egypt are paralleled by those of no other river in the world. The other rivers on which high civilizations have arisen are the Euphrates and Tigris, the Indus and Ganges, and the great rivers of China. In all these cases irrigation is practised, but not in the way that is normal in Egypt. In Mesopotamia, the flood reaches its maximum at the end of May, and the rivers are again within their banks in June. But this is full summer, and plants which appear after the flood has left the plain have no chance of reaching maturity. The soil dries so rapidly that the mud is replaced by dust in the course of a few days. The flood is caused chiefly by the melting of the snow on the mountains of Armenia, which, of course, begins with the return of late spring. The plain of Mesopotamia is rainless in summer, so that the dry mud remains a barren waste. The few showers that mark each year occur in midwinter. These floods, therefore, require regulating before the water can be used for profitable irrigation, for the single application of water, which comes naturally each year, is not capable of bringing any crop to maturity. "Under the extreme conditions of heat and dryness, which prevail in summer, it would be lost labour to sow seed, which, though it might germinate, would wither away before coming to maturity."†

These conditions in Mesopotamia must be borne in mind, because they are all-important in their bearing on the question of the priority of Egyptian or Babylonian civilization, and also on the still more fundamental question of the most probable localities for the evolution of barley and wheat before man interfered in the process.

In India, the two great rivers are fed from the snows of the northern mountains, and the floods come early in summer, so that conditions there are similar to those of Mesopotamia. In China, the floods are caused chiefly by the heavy local rains which occur during the summer months. Thus the incidence of the flood season is all in favour of Egypt as the place where the art of irrigation originated. It is the only land where the annual flood produces crops without any assistance. On the Euphrates, the preliminary requisites are an embankment to keep off the flood and a canal to bring the water from the river at the proper time of year.

The usual assumption, that cultivation began by making use of the rainfall instead of by irrigation, presents difficulties which on examination appear to be insuperable. The Australian aborigine has been gathering and crushing seeds for untold ages, and also robbing the ants of their store of such seeds, yet neither the ant nor the black

* On the Origin of the Idea of the Supernatural.
† Hanbury Brown, "Irrigation," 1907, p. 3.

man has learnt the art of cultivation; and we shall show later on that barley and wheat are the plants which appear to have had a special, and not an ordinary, natural history. The problem is to account for the idea of cultivation coming into the mind of the savage. Ratzel says, "That agriculture in the tropics is limited by the hostility of the forces of nature, and in temperate climes by the lesser fertility of the soil and the less favorable climate."* This writer is, I think, quite wrong in his estimate of fertility and the drawbacks of a temperate climate. But the older writers assumed that man must have learned the possibilities of vegetable food by his experience of tropical fruits, and that, therefore, agriculture began in the tropics—the happy South Sea Islander idea. Equally erroneous are the words of Schrader:—"In reality, the links in the chain of development by which agriculture rises are innumerable. . . . it must have been a work of unutterable difficulty to prepare the forest soil of ancient Europe, matted, as it was, to receive the grain."† The reality to which the first link was fastened is the difficulty—once the first link has been forged, the chain is a very short one. If the rainfall is not too heavy, the forest and its scrub present no difficulty, because the large trees can be killed by ring-barking, and the scrub be burnt; and the denser the undergrowth, the fiercer the fire and the more effectively the roots are killed. In Australia, the first crop of wheat is often seeded on the ashes. The great trees are burnt wherever they fall, perhaps 50 years after they have been killed. In the meantime, there is no difficulty in working between the trunks with a single-furrow plough, and there was even less with the mattock or primitive plough. Hence all Schrader's assumptions may be false and artificial.

The current theory is that agriculture began in many independent localities by a series of gradual steps. But heavy rainfall regions may at once be ruled out as probable places for agriculture to have begun. Under natural conditions, the amount of animal life in dense forests is singularly small compared with what is found in the open plains or the lightly timbered country. The heavy forests were, therefore, seldom visited by the Australian aborigines; they had the same habits as the wild animals, and lived in the more open country. Here we are met with this position: If we assume that cultivation began with sowing small seeds, such as those gathered by the ants, the outstanding fact, as the good and bad seasons follow each other, is that it is always a feast or a famine. In good years, the plains are covered with endless miles of tall grass, often up to the horses' girth, sometimes up to his shoulder, so that there is no inducement for the native to try to cultivate, because all he could do would be less than a drop in a bucket. If the first of the "innumerable links" was sowing some of this grass at the commencement of what happened to be a bad season, then the theory will not work in practice. On just the year when the new food supply was most wanted the new sown crop would refuse to grow. Luxuriant crops and billowy pasture, poor crops and bare fields, always go together. Nowadays, with bare fallowing and other "dry farming" methods, the farmer may grow a better crop than nature produces in

* History of Mankind, 1896. I, p. 91.
† "Prehistoric Antiquities," 1890, pp. 287, 289.

the pastures, but this is quite a modern achievement. We may be sure that early man could not do so. The less cultured of savage people have little foresight or perseverance, and it is easier for them to follow the river beyond the limits of the drought rather than stay behind and see how the new-fangled experiments are likely to succeed. Charles Darwin quotes evidence as to the wretched food used by the savages, and tells of the Australian blacks cooking many kinds of vegetables in the hope of rendering them innocuous or more nutritious. After mentioning the Africans gathering grass for food, he continues:—"The savage inhabitants of each land, having found out by many and hard trials what plants were useful, would, after a time, take the first steps in cultivation by planting them near their usual abodes." He states that Australia, New Zealand, Cape Colony, and North and South America beyond Mexico and the Plata respectively, have yielded no plant useful as food for man. He then suggests that, as Australia produces 107 species that might be useful to savage man, it may be only a question of cultivating them for thousands of years to enable them to compete with those already in use in the civilized world.*

But, if the Australians, who know what hunger means as well as most savages, have no idea of the meaning of cultivation, why should savage man in any part of the earth have got the idea of improving the food value of the grain? If, as it appears, an object-lesson in cultivation was being given by nature year after year to the Egyptians before they grasped the idea, it is idle to pretend that thousands of years earlier some man began breeding plants. But we have to go much farther than this. Not only did one man begin the new task, but he was able, by his example, to stimulate the first of a long succession of enthusiasts to imitate him, to hand on the secret, to preserve the best of the seed through times of famine, and thus to accomplish what no one else has been able to do—make a permanent increase in the size of the grain of wheat and barley. If the cereals began as small seeds, what conviction of ultimate success, or what instinct led some primitive man to begin the task? Presumably, if there is any truth in the supposition, hundreds of grasses were experimented with, but only two—wheat and barley—have turned out a success. The conception of starting to improve a seed is very different from cooking roots to make them eatable. Aaronsohn, who recently found wild wheat with large seeds growing in Palestine, argues that primitive man would not select a useless and inconspicuous grass for cultivation. "It would have taken a wonderful power of divination on the part of our prehistoric ancestors to pick out one grass and to find that this grass had such possibilities. We have done no such thing with the thousands of other species of grasses."† The adoption of clothing would appear to be a much simpler step for a savage to take than the discovery of agriculture. Speaking of the habits of the naked aborigine, Spencer and Gillen remark—"The idea of making any kind of clothing as a protection against cold does not appear to have entered the native mind, although he is keen enough upon securing the Government blanket

* "Animals and Plants under Domestication," I, p. 324 *et. seq.*
† Quoted by Coulter. Fundamentals of Plant Breeding, 1914, p. 192.

when he can get one."* Yet these people are continually hunting fur-bearing animals for food, and at night in winter the temperature often falls several degrees below freezing point for weeks together.

The stories current among the Egyptian priests do not help matters. They were written down by the Greeks about 2,000 years ago. They are, therefore, too late to be of value, and they deal chiefly with wheat, whereas wheat was discovered later than barley. Barley was in use probably for several generations before Isis, the reputed discoverer of corn, had any association with the moon. Another tale, in which Osiris figures as the benefactor of mankind, has given rise to the theory of the corn spirit, the (supposed) original phenomenon being the sprouting of some of the corn which was buried with the body. This theory is fortified by the two specimens of the "Osiris bed" in the Cairo Museum. In these, the figure of the god has been outlined on the canvas filled in with earth and planted with corn.† But the date of these relics (Eighteenth Dynasty) is too late for them to have any significance as to the origin of agriculture, while the drift of the writings of that period would make it more probable that they were invented simply to strengthen the faith in the future life. It is certain that the earliest graves in which food is known to have been placed beside the body are those of Upper Egypt. Here the hot desert sand is never moistened by rain, and, therefore, the corn does not germinate. The Egyptians were skilful farmers many hundred years before the earliest known appearance of a corn spirit in Greece, or even in Syria. Such evidence is much too modern.

* Native Tribes of Central Australia, 1899, p. 17.
† Viewed through the glass case the species cannot be identified by the shoots and seeds.

(To be continued.)

According to the *Agricultural Gazette of Canada,* a month's campaign in favour of individual testing of cows was organized in the province of Quebec, all inspectors of butter and cheese factories and all country agricultural representatives taking part. The seed scattered by these officials fell upon good soil, and over 30,000 cows were entered by the more progressive farmers of the province. The entry was so great, in fact, that the supply of bottles, acid, and scales was quite insufficient, and many owners were unable to get the apparatus with which to test their cows. Ample plant has been insured for the next testing period; but, even as it was, 16,000 dairy cows were actually under test in the province in 1920. Individual testing is the only way to get rid of the boarders—the cows that eat up the profits of the herd.

CROP AND FALLOW COMPETITIONS, MINYIP, 1920.*

Report of Judge, H. A. Mullett, B. Ag.Sc., Chief Field Officer.

THE COMPETITION.

In the four sections of the competition, there was a total of 29 entrants, a field which may be described as satisfactory.

The season was an excellent one, and the wheat crops correspondingly good. Taking them for a radius of 15 or 20 miles round Minyip, they were probably on the whole more uniformly prolific this year than those in any of the seven Wimmera districts inspected. Competition was therefore keen, and some difficulty was experienced in separating the contestants.

Results.

Section I.—Best Half of Farmer's Wheat Crop not Less than 50 Acres.

The results in this section were a triumph for the summer-fallowed crops. The winning crop, and the best portion of every other crop exhibited in the section, was sown on summer-fallowed land. A. H. Krelle, of Coromby, was placed first with 97 points; A. Lutze second with 92; and E. and M. Boschen third with 91.

Mr. Krelle's crop comprised the best half of a 100-acre paddock of Federation wheat. It was remarkably dense and well headed. In every way it was a show crop. There was an entire absence of wild oats, and the whole of the seed having been obtained direct from the Longerenong College, the crop was practically true to type. The summer fallow on which this wheat was grown was ploughed to 3 inches in March. It was harrowed early in May, and again early in July. At the end of July it was scarified, harrowed in the second week in August, scarified again during the first week of November, and harrowed finally before harvest during the third week in November. Following a summer rain, it was harrowed again while the soil was still moist, and then left till seed time.

The crop was then put in with a combined spring-toothed cultivator drill, and afterwards harrowed. Seventy-five pounds of graded selected Federation wheat was sown, with 112 lbs. superphosphate per acre, Seeding took place from 10th to 18th June. The later-sown crop was the heavier. I attribute the striking success of this crop, which was easily the heaviest seen in the district, to the thorough preparation of the summer fallow, especially the use of the light implements after the final scarifying in November. The season set in especially dry from then on; and, under these circumstances, the fallows on the black land required working with great judgment in order to maintain the essential consolidation of the under layers. The summer fallow lends itself to weed killing before harvest time, consequently, the use of heavy implements, such as the scarifier, may frequently be dispensed with in a

* This report has been in type for several months; pressure on our space has prevented its publication earlier.—Ed. *J. of Ag.*

season like the present, and their place taken by the harrows. The crop may then be put in with the combined cultivator drill to advantage, as was done in this case.

The use of a heavy seeding of selected graded seed, together with ample supplies of manure—if the results of the experimental plots at Longerenong may be taken as a criterion—are factors which have also contributed to the result.

Mr. Lutze's crop consisted of 110 acres of Huff's Imperial and 20 acres of Federation wheat. Huff's Imperial is a new variety, short and clubby, and apparently a prolific yielder. It has been grown by Mr. Lutze for several years, and has proved a success. Its use is extending in the Wimmera. Messrs. Worth Bros., at Horsham, showed a heavy crop of it in the Horsham Competition.

The heaviest portion of this crop (about 60 acres) was sown on summer fallow. The remainder was winter fallow, which was ploughed

The Winning Crop—Mr. A. H. Krelle's.

in July from 4½ to 5 inches deep. It was then harrowed twice, then scarified, and re-scarified in December. Towards the end of May, the paddock was given a stroke of the spring-toothed cultivator. It was sown from 1st to 10th July with 75 lbs. seed and 100 lbs. superphosphate.

Messrs. E. and M. Boschen's crop of Federation was also an excellent one. It was sown with 70 lbs. of seed and 90 lbs. of superphosphate during the second week in June. At the time of judging, it was ripening off with a nice healthy bronze colour. The summer fallow on which the crop was grown was ploughed lightly in March, scarified in July, and again in September. After harvest it was harrowed, and then scarified in front of the drill.

The crop of Federation shown by Mr. A. J. King was an interesting one, and the yield was heavy. The fallow on which this crop was grown received very little working after the original ploughing, but was well sheeped. Seventy pounds of wheat was sown, with 90 lbs. of superphosphate. The main portion was sown from 14th June to 2nd July.

Details of Results.—Section I.

Name.	Yield.	Trueness to Type.	Disease.	Weeds.	Evenness.	Total.
Possible Points	**35**	**20**	**15**	**15**	**15**	**100**
A. H. Krelle	35	19	14	15	14	97
A. Lutze	33	18	14	13	14	92
E. and M. Boschen ..	29	19	14	14	15	91
T. Hemphill	30	16	13	14	15	88
H. H. Niewand	27	12	15	13	15	82
A. J. King	29	18	7	12	15	81
P. C. Schultz	26	13	10	13	4	66

Please note that the figures for yield do not represent bushels per acre. The actual yields were higher than the percentages shown. The differences between them may be taken to represent fairly accurately the differences in apparent yield.

A Comfortable Farm Home—Mr. P. C. Schultz', Minyip.

Results.

Section III.—For the Best Crop on Fallowed Land—the Fallow Judged 1919, and the Crop on the Fallow 1920.

(Points for crop and fallow to be added together.)

This section was begun in 1919, when prizes were awarded for fallow. The crops were judged this year. Mr. A. H. Krelle was the winner, with a total of 185 points. This includes the same crop as that which won in Section I. Mr. Lutze was second, with 179 points. In this section, another portion of Mr. Lutze's crop was shown. Mr. J. Ruwold was third, with 174 points.

The winning crop has already been described. Mr. Lutze's comprised 115 acres of Huff's Imperial and Federation, sown on summer fallow. The crop was seeded from 10th to 25th June with a combination cultivator-drill; 60 lbs. of seed and 92 lbs. of superphosphate were used. A portion of Mr. Lutze's crop had gone off in "take-all," a phase which will be referred to later.

One of the heaviest crops shown in this section was that of Mr. H. Morris. An area of 125 acres of Federation was grown on summer fallow. This was scarified at the end of March, and harrowed; then skim-ploughed and harrowed in August. It was then repeatedly harrowed as follows:—One stroke each in October, November, February, and April. The first scarifying before seeding was given early in June. A further scarifying took place about the middle of July. The crop was sown from 22nd to 28th July with 100 lbs. seed and 120 lbs. manure per acre. Mr. Morris strongly believes in summer fallowing, and finds it about two bags better per acre on the average than winter fallow. The judicious use of the light implements, and the heavy dressings of seed and manure, were also factors, no doubt, in helping this crop, as they were in the case of Mr. Krelle's. Points were deducted for the presence of foreign heads.

Mr. Ruwold's crop was sown on a fine piece of summer fallow, but was lightly seeded and manured. Fifty-five pounds of wheat and 67 lbs. of superphosphate per acre were used. Sowing was made at the beginning of July.

Details of Results.—Section III.

Name.	Yield.	Trueness to Type.	Disease.	Weeds.	Evenness.	Total for crop, 1920.	Total for Fallow, 1919.	Grand Total.
Possible points ..	**35**	**20**	**15**	**15**	**15**	**100**	**100**	**200**
A. H. Krelle ..	35	19	14	15	14	97	88	185
A. Lutze ..	29	17	12	15	14	87	93	180
J. Ruwold ..	29	19	9	13	15	85	90	175
H. Morris ..	32	16	13	15	15	91	83	174
R. J. Cowan ..	30	18	12	11	15	86	87	173
R. J. Hemphill ..	27	19	12	14	13	85	86	171

Results.

Section II.—For Best Fallowed Land not Less than 100 Acres.

(Each competitor's fallow to be shown.)

The fallows, on the whole, were not in such good order as in other years. The dryness of the season during the early winter, followed by a wet spring, rendered the killing of weeds somewhat difficult. Mr. Krelle, however, showed a paddock of 112 acres of splendid fallow. There was an effective dust mulch above, and, as a result, high moisture content below. The packing of the under layers was perfect. Portion was summer fallow and portion winter fallow.

The summer fallow was scarified in March, again in July, and again in August. It was then harrowed, re-scarified in November, and harrowed. The winter-fallowed portion was ploughed in August to 3 inches deep and harrowed. It was again scarified in October and harrowed, and finally it was re-scarified in November, and given a stroke of the harrows immediately after.

Mr. McGilp's fallow was also in two portions. It was winter fallow. The best portion was ploughed to 3 inches in July, then harrowed twice,

then scarified, and then harrowed twice. The second portion was ploughed late (August). The consolidation was not all that might be desired.

The main faults with the remainder were deficient consolidation caused by late working, and in some the presence of deleterious weeds, like barley grass (a host of "take-all"), and mustard, &c.

Details.—Section II.

Name.	Moisture.	Dust Mulch.	Weeds.	Cultivation.	Total.
Possible points	**25**	**25**	**25**	**25**	**100**
A. H. Krelle	24	25	25	25	99
A. D. McGilp	22	25	25	22	94
H. A. Niewand	21	21	25	22	89
P. C. Schultz	20	23	25	21	89
A. Lutze	23	22	20	23	88
R. J. Cowan	20	23	23	22	88
F. Burton	19	19	21	21	80
T. M. Burton	19	18	21	21	79

Results.

Section IV.—For Beet Crop Grown on Fallow Land—the Fallow to be Judged 1920, and the Crop Grown on the Fallow in 1920.

(Points for crop and fallow to be added together.)

In this section the prize is not awarded till next year. The same competitors as in Section II. took part, and the marks awarded are identical with those allotted to competitors in that section.

POINTS FROM THE COMPETITION.

"Take-all."

Everywhere throughout the Wimmera this year record crops were harvested; yet the majority of them were more or less affected with "take-all". In a number of cases, the outbreak was of sufficient virulence to cause the ruin of whole paddocks of wheat. In many cases where the disease attacks the crop in the early stages, there is very little visible evidence at harvest time save the weak patches in the crop. This sometimes leads to the loss caused by "take-all" being overlooked. Black Rust is another similar disease which works in this insidious fashion.

It would not be very wide of the mark to assess the damage to the wheat crops in the Wimmera and Mallee during the present season at 10 per cent. The value of the wheat raised in the State this year cannot be far short of £20,000,000 sterling; and if the remaining districts were as badly affected as those of the Wimmera and the Mallee, the total loss to the State must be £2,000,000.

To the individual farmer raising his 2,000 bags of wheat, it means a personal loss of something like £270. It pays, therefore, to take steps to check these diseases.

It is very probable that the prevalence of "take-all" in the Wimmera and Mallee districts is closely associated with a combination of two factors. The first is the present practice of heavily cropping the

Heavy Crop of Federation Wheat, "Take-all" free—Mr. A. Lutze's, Minyip.

(A fence separates the paddock in which this crop grew from that in which the crop illustrated below was grown.)

Wheat Crop showing ravages due to "Take-all" at Mr. Lutze's, Minyip.

land to wheat, and the second is the careless burying of the stubbles, or what remains of them, after the stubble is fired. Once the wheat crop becomes infected, it is this undecayed straw that can carry the

spores of the "take-all" fungus on to the next wheat crop, even though there be no host plant, such as barley grass, growing on the fallow. It is a common sight to see particles of straw lying everywhere on the Wimmera fallows six months after ploughing time. It is the crop grown on this type of fallow, especially where poor consolidation has been effected, that "goes off in 'take-all'." At least, that is one's impression after four or five years' systematic examination of hundreds of Wimmera fallows and the crops raised on them.

A typical case was seen at Mr. A. Lutze's place at Coromby this year. There a wire fence separated two paddocks, in which the yields differed by five bags to the acre. The one with the lower yield showed large thin patches where the true "take-all" had been at work.

The history of the two paddocks was as follows:—

1st Paddock. "Take-all" infested—	2nd Paddock. Clean crop—
In grass three or four years.	Fallow.
1915. Fallow.	1915. Wheat.
1916. Wheat—yield 13 bags per acre.	1916. Fallow.
1917. Fallow.	1917. Wheat—12 bags.
1918. Wheat—yield 10 bags.	1918. Oats.
1919. Fallow—stubble not burnt.	1919. Summer fallow.
1920. Wheat—yield 5 bags.	1920. Wheat—yield 9-10 bags.

These two fields had been heavily cropped to wheat. In the case of the one that grew a clean crop this year, it had been previously spelled with oats, and the wheat was sown on a well-worked summer fallow. The other paddock, on the contrary, had not been spelled to oats for a number of years. The stubbles of the 1918 wheat crop were not burnt, and the working of the fallow was somewhat neglected during the spring. The result was a severe outbreak of "take-all." The oat crop undoubtedly helped in starving out the disease, but an occasional oat crop in itself is not sufficient. Care must be taken to secure a thorough burying and decay of any vestige of straw that remains. The ploughing should be deep enough to effect that, and the fallow should be well worked after rain throughout the spring and autumn. That is the type of fallow which grows the clean crop, especially when it forms part of a rotation system which provides for the spelling of the land in oats and grass in a systematic way.

The present popular method of cropping land every second year in wheat for a series of years really provides but one-sixth more land for wheat than if it were cropped every third year only. In practice, more wheat is grown by the latter system in the long run, because the yields are better maintained over a period of years, and an enforced rest, due to a severe outbreak of "take-all," is rarely necessary. Where an occasional oat crop can be introduced, and the land farmed on this or any other rational system, there will be little cause to complain of "take-all."

The same remedies that keep "take-all" in check help to eradicate "black rust." The feeding to horses of chaff infected with "black rust" is bad practice, because the spores of the fungus can pass unharmed through the intestines of the animal, and hence re-infect the paddock.

Fallowing Methods.

Farmers in the Wimmera are generally divided into two schools with regard to the maintenance of the fallow on black land once it is prepared. The great majority firmly believe that it is of advantage to work the fallow during the spring, summer, and autumn after any heavy showers of rain that may fall. They find that a good harrowing after rain in the spring, summer, and autumn, means a bushel or two of wheat extra to the crop. On the other hand, there are not a few who aver that, provided the land is well sheeped, a minimum of work is all that is necessary. Messrs. Smith Brothers, of Horsham, and Mr. A. King, of Minyip, are among those who subscribe to that view; and it is true that they grow satisfactory crops of wheat.

Method of handling hay at Mr. Lutze's, Coromby.

There is no doubt that, on the friable land in the Wimmera, sheep play an important part in consolidating the fallow, in maintaining it free from weeds, and in keeping the surface loose. But the consistent success in the farm competitions of the men who work their land well, and also sheep it thoroughly, scarcely leaves room for doubt that when the labour is available the extra working pays. The matter is, however, entirely a business proposition; the farmer knows that a certain contemplated working will yield him an extra bushel or so of wheat. He has to calculate on the spot whether it will pay him to get that bushel. There are occasions, such as during harvest, when, undoubtedly, it will not be profitable to neglect other important work; but the greater part of the time, it will pay to keep the teams going on the fallows so long as they are damp.

Wimmera Rye Grass.

The magnificent stand of Wimmera rye grass on the property of Messrs. H. McDougal has been the subject of considerable interest to all Wimmera farmers who keep sheep. Large quantities of the seed have been distributed over the State, and in many cases to other States. The reports received as to the carrying capacity of the grass are most satisfactory. It has done surprisingly well at the Experiment Farm, Rutherglen, at Longerenong College, at Nhill, Goroke, and even south of the Divide. There was never any question as to its superior feeding qualities; the points at issue are its powers of re-establishing itself annually on soils other than Wimmera, and its controlability in wheat lands in the Wimmera and Mallee.

At Rutherglen, and at Longerenong, it has shown a persistent tendency to re-establish itself on fallows from seed, but by extra working it has been dealt with. The experience, however, is sufficient to indicate that it would be troublesome in a wet year on farms under-stocked with sheep, or when the fallow is not well prepared.

In those cases, it is likely to interfere with the yields of wheat; but if sufficient sheep are run, there will be a corresponding gain from them.

The interest on capital earned by one Wimmera farmer where the pastures are wholly of Wimmera rye grass, compares favorably with some of the competitors in the Royal Agricultural Society's Farm Competition. The area of this farm is 1,100 acres, and the area sown to wheat is only 200 acres.

In the southern districts, the grass has done well on all classes of soil in the first year of its growth. It establishes itself well on friable soils, as at Hamilton, in the Western District, and Drouin, in Gippsland, but appears to grow poorly after the first year on stiff, cementy soils on the western plains, as at Willaura.

WHEAT AND ITS POWER OF GERMINATION.

"It is not possible to state definitely how long a grain of wheat will retain its power of germination," says the Director of Agriculture of South Australia (Professor A. J. Perkins). There is not the slightest doubt, however, that the percentage of seed that germinates in any given sample of wheat becomes lower from year to year, and it is probable that, if kept thoroughly dry, some grains would survive for several years, say, seven or eight years. Professor A. J. Ewart, of Melbourne, carried out several experiments in this direction, and came to the conclusion that within eight to ten years over 50 per cent. of the grains in a sample of seed-wheat would have lost all power of germination.

CALF REARING.

Lecture Delivered by J. M. Kerr at Dookie Agricultural College, 10th August, 1921.

The rearing of male calves from ordinary dairy herds does not promise much profit at the present time, but there is no doubt that, provided the right quality of bull is kept, every dairyman would gain by raising at least the female calves from the best of his cows. New animals of some kind are necessary to replenish the herd from time to time, and it is much preferable for a dairyman to use animals of his own rearing for the purpose than to depend on haphazard purchases in the sale ring. It is the only way to reap the advantage which breeding offers, and it has the further recommendation that it is much safer for the health of the herd. With a disease like contagious pleuro-pneumonia, as prevalent as it often is, a certain risk is always run in introducing strange animals to a dairy herd. Even though the returns from skim milk fed to pigs are so high, they cannot be greater in the long run than those obtainable from rearing the most select of the dairy heifers bred on right lines.

Care of Cow at Calving Time.

Although ordinary cows are generally allowed to shift for themselves at calving time with very few mishaps resulting (especially if they have the run of a large paddock containing cover) care should be taken with valuable cows or with those on small holdings, where the animal cannot segregate herself from other stock. It is then advisable to place the expectant mother in an enclosure from which other stock are excluded, and where she is not likely to be otherwise disturbed. If this reasonable attention is provided, the cow will generally come through the ordeal safely; but, of course, a watchful eye should be kept on her throughout.

Treatment of the Cow during Pregnancy.

Just a word here as to the practice of turning a good cow that is pregnant out into the back paddock when she becomes dry. If the back paddock is the usual variety, with nothing better than the native grasses available at best, the practice, if not actually cruel, is certainly not fair to the cow, and she and the calf with her must suffer in consequence. If the appeal on humane grounds has no effect, there is another which might be more successful, and that is, "*It does not pay.*" At the stage when the cow is dried off, the fœtus has developed sufficiently to be a considerable drain on the cow's vitality, and there is little justification for depriving her of all nourishing food just because she is not giving an immediate return in milk. She will pay for it, and with interest, later, if the owner will only see that she gets at this time the extra proteid food her condition requires, in the way of a little concentrate, or else green leguminous fodder such as lucerne, clover, or trefoil, along with the less nutritious pastures. The hay form of these legumes is good also, and so is oaten hay, but with the latter a few pounds of bran a day would not come amiss.

Dairymen generally do not realize sufficiently the beneficial effect, not only on the calf, but also on the cow, which results from never

letting the latter get low in condition at any time. A dairy cow will invariably recoup the owner for feeding when dry by a higher test during the next lactation, which, of course, means more butter.

Treatment of Newly-born Calf.

The calf is better removed well away from the mother before it has had time to suck; not only does the mother fret and bellow less, but the calf learns to drink much more quickly and easily. The first milk, however, should always be reserved for it. This is the colostrum, commonly called beastings, and is nature's own provision for the new-born calf. It is especially rich in the growth-producing ingredients—ash and albumen—and, further, has laxative properties which operate beneficially on the young animal's bowels, which are usually more or less constipated.

Feeding the Young Calf.

Calves should be taught to drink without the finger. This saves much labour, which can be better exercised for the calves in other directions. If, however, a calf gulps its milk excessively enough to cause digestive trouble, the finger in that case acts as a check, which may be worth the trouble. Rubber teats are unnecessary, and usually are not kept sterilized, thus causing serious derangement.

Calves should never be allowed to over-drink. If the quantities can be measured or weighed out, so much the better—2 quarts or 5 lbs. by weight of milk is quite enough for a single meal—but, where numerous calves have to be fed, a practical way of ascertaining when a calf has drunk sufficient is to watch the left hollow (in front of the hip) swelling until the skin becomes almost levelled up with the surrounding surface; this indicates that the calf has had a sufficiency, and it should not be allowed to drink further. Where there is but one calf, the utensil containing the milk should be removed; when there are several fed at the one trough, they may be checked by the use of a small whip.

In this connexion it might be mentioned that small bails are sometimes provided, in which each calf is taught to bail up when feeding. These are not essential, but they are certainly useful in insuring that each animal gets its proper share; further, this early training will probably have the effect of making them more docile and tractable as heifers.

Three small feeds a day are probably best for the youngest calves, but twice-a-day feeding (morning and evening) prevails generally, and seems to serve all practical purposes, and, as long as a calf is doing well, there is no need to depart from it. Food engorgement or over-distension of the stomach is, next to dirty feeding vessels, the commonest cause of "scours." Only clean utensils should be used for feeding. This is very important, and, therefore, kerosene tins and dented and cracked buckets cannot be recommended. Whatever vessels are used should be cleansed after each using.

Advisability of Rearing Calves in the Open.

Calf pens and sheds are a doubtful blessing. The enclosed ones are often vile smelling, and almost invariably objectionable. They are apt to harbour germs owing to exclusion of sunlight and fresh air, which with exercise are very life to a young calf. In this climate enclosed

sheds may well be dispensed with altogether; and, if sheds are used at all, they should be fairly lofty and fully open on one side (preferably the east), with all surface drainage from higher ground diverted. In any case, a calf requires to be penned up only for the first few days, till it and the mother forget each other, after which it is better for the run of a small and clean paddock, with optional access to a sanitary and open shed. Warm hedges that shelter are equally good for all practical purposes. Well-fed calves at liberty to exercise will suffer no harm from ordinary weather conditions if the shelter of breakwinds be afforded them. Paddocks heavily coated with dung or other organic matter, or which receive drainage from stable or milkingshed, should be shunned.

The Necessity of Green Feed.

The raising of a small number of calves rarely presents any difficulty; it is when large numbers have to be raised on old dairy farms that trouble is most likely to occur. This is most frequently due to soil contamination, which gives a paddock the reputation of being "calf sick." If this trouble is being experienced, the calf paddock should be ploughed up and dressed with at least a ton of air-slaked lime to the acre before re-seeding with grass fertilized with superphosphate. The lime decomposes the excessive organic matter in which the germs of contamination lurk, and the fertilizer promotes the class of pasture most fitted to tone up the animal.

Green feed, clean and fresh, has special virtues for either old or young calves, and where calves are being reared an endeavour to have such feed should be made. Perhaps there is nothing better than prairie grass, which has an added virtue in its early growth. This and a clean water supply, especially in summer, are two accessories which, next to a supply of skim milk, constitute the greatest boon to the calf rearer. Closely-grazed or bare pastures are dangerous for young calves, particularly during wet seasons. Soil particles are ingested with the food, and these, in wet seasons, frequently contain the eggs of parasitic worms—a very common cause of ill-health in calves.

Feeding during first few Weeks.

Whole milk is necessary for the first three weeks. An average-sized calf at this age should never receive more than 2 quarts at a meal, fed fresh and warm. At three weeks a small quantity of separated milk (fresh and free from froth) should be blended with whole milk to make the quantity, gradually increasing the proportion of skim, but not the total drink, until at five weeks no whole milk at all is being added. Never give excess; never feed frothy or cold milk to calves. A few days before the liquid diet is reduced to skim milk completely, start to add one teaspoonful of boiled linseed-cake-meal, gradually increasing within the next few days, until a tablespoonful is being added for each meal. This will improve the feeding properties of the skim milk; and the quantities, viz., 2 quarts of skim milk and 1 tablespoonfull of linseed meal (boiled) twice a day need not be increased during the whole course of feeding, provided the calf has access to water and green picking from the beginning, and is given bruised oats in a trough to be eaten at leisure. Oaten or lucerne hay is relished by calves, and is good for them, but the chaff is not quite so suitable. This diet is sufficient for rearing the very best of dairy heifers, which whole milk

entirely will not do. Calves are particularly fond of ensilage, and thrive well on it as a supplement to the bruised oats.

The Use of Substitutes for Milk Food.

Many farms have no skim milk, and it then has to be dispensed with, but no substitute has the growth-producing properties in such high degree. This is due to its complete and excellently balanced food ingredients. It contains the proteid and carbohydrate essentials in the most digestible of forms, and this is very important, with the carbohydrate ingredient especially. This (the milk sugar) does not require as prolonged a contact with the saliva of the mouth as vegetable forms of starch, which by their nature are meant to be masticated. As the young calf must receive its starch in liquid form, prepared foods present a difficulty in their less soluble starch. The nearest approach to surmounting this is by boiling them to a gruel. Milk has another very fine virtue in its high mineral content, which also possesses a degree of assimilability unequalled in any possible substitutes. And, further, milk is especially rich in certain substances named vitamines, which have recently been found to be essential to animal growth and nutrition.

Now, these three feeding-virtues of milk, viz., milk-sugar, mineral matter, and vitamines, are retained in whey—the two former almost entirely, and the latter to a less extent. The great deficiency of whey, as compared with skimmed milk, is due to the curd extraction. Curd is the proteid ingredient of milk, and consequently for feeding calves whey should be supplemented with something of the same nitrogenous nature. For this purpose ground linseed cake, being high in protein, is again excellent, but in slightly greater proportion than for skim milk. Lucerne is a fine supplement for calves that are being raised on whey. Only fresh whey should be used. Both skim milk and whey, if from other than an owner's own cows, should be subjected to scalding temperature for some time as a precaution against introducing with the food, the disease-germs of tuberculosis. In the absence altogether of skim milk or whey, calf foods varying in composition are generally resorted to, and, providing the calf has received a sufficient grounding on milk, most of the prepared calf foods answer the purpose. There is no need, however, to go past a mixture of ordinary linseed meal (linseed cake finely ground) and pollard. Where calves have to be raised entirely without skim milk this is known to be giving quite satisfactory results. In such case the feeding should be as follows:—

1st Week.—Mother's milk, warm.

2nd and 3rd Weeks.—Whole milk, warm.

4th and 5th Weeks.—Gradual substitution of linseed and pollard gruel by mixing with the whole milk in gradually increasing quantities, starting with one teaspoonful up to the full quantity, at the same time substituting warm water for the milk, till at end of fifth week milk is entirely discontinued. The full allowance for each meal per animal is ¼ pint of linseed meal and half as much pollard.

To make the gruel, bring the mixed meals to the boil in slightly salted water twelve hours before feeding, and allow to cool down and soak till feeding time—not longer than twelve hours, or it will probably sour. Never feed more than 2 quarts of water with the gruel for a meal. Give two meals a day. The calves should have access, after feed-

ing, to bruised oats, oaten hay or ensilage, maize ensilage, and also pasture as good as can be made available. Lucerne, clover, or trefoil are especially serviceable in the absence of milk, because, like it, they are rich in bone-making lime.

Carob Beans as Calf Food.

The Carob bean (*Ceratonia siliqua*) trees at the College, and the presence in the audience of so many farmers from northern districts, where this highly ornamental tree does so well, prompts reference to the utility its fruit possesses for calf feeding. The pods are rich in an easily digested sugar, and in America are commonly ground, beans and all, to form portion of gruel rations in the entire absence of skim milk. Northern farmers would do well to note that the three most beautiful trees about the College grounds, viz., the Carob bean, the cork oak, and the olive, are utility trees as well, which they themselves might well introduce to their own districts in numbers, not only for the improvement they would effect in the appearance and shelter of the home environment, but because also of the commercial value of the products. Though experience has proved that nothing more than oil-cake and pollard need be looked for as a suitable gruel for calves, a farmer having Carob trees and a grinding mill might put them to use by adopting the following gruel mixture recommended in an American publication, and containing Carob pods finely ground into meal, viz., 14 parts finely-ground linseed cake, 5 parts finely-ground whole linseed, 2 parts wheat flour, 2 parts finely-ground Carob-bean meal. Use 3 lbs. of the mixture with 5 quarts of water, add a little salt, and bring to the boil. The calf should have whole milk for three weeks, then two parts of liquid gruel and three parts of whole milk. Gradually increase gruel and reduce milk, till at fifth week calves are getting equal parts. Further, increase gruel content to three parts to one of milk at seven weeks, and, after that, gruel only. A meal should never exceed 2 quarts. Any gruel feed is more successful with winter-born calves, because there is green pasture for them at the most opportune time.

Calf Ailments.

The ailments of calves are most commonly due to digestive trouble, and in this connexion it should not be forgotten that too violent a change of diet is very apt to upset a young animal's digestion. Changes of food ingredients should be introduced gradually, so that the animal may accustom itself to the alteration. Neglect to do this has killed many calves, especially among those that are low in condition. Even if the change be back to milk, it will often prove fatal with animals low in health through digestive trouble. In a general sense there is no medicine like clean green feed for a calf's digestion. This is probably due to the vitamines beforementioned, which green fodder so largely contains. Worms of both the intestinal and lung varieties have been known to resist all manner of dosing until green feed became available. The early springing grasses, like prairie grass and *Phalaris bulbosa,* are particularly useful here, and a young crop of Algerian oats seems no less beneficial. Scouring calves have been cured by green oats, while others from the same lot similarly affected have been killed by fresh whole milk. Chaff also is bad for a week scouring animal, long feed is very much better.

PEACH-GROWING IN VICTORIA.

(Continued from page 504.)

By A. G. McCalman, Orchard Supervisor.

XII.—INSECT PESTS.

The most injurious insect enemies of the peach are sucking insects as distinct from chewing insects, and must be dealt with by sprays which kill by contact. Internal poisons, such as arsenate of lead, are of no use.

Black Peach Aphis.—This is a small insect about one-twelfth of an inch in length, black and shining when full-grown, brown when in the larval stage. These insects may often be seen in the winter clustering on the under side of twigs. As the weather gets warmer their numbers increase enormously and a badly infested tree soon becomes black with them, and sticky with their secretions. With their beaks (rostra) they pierce the bark of the twigs, and sucking the sap, cause the twigs to curve downward owing to the loss of sap on their under side. The females give birth to living young, and also lay eggs, which are frequently to be found behind the buds in the winter.

The insects hibernate on the roots of the trees; in order to insure the planting of clean trees, they should be submerged in tobacco water, as described in the January issue of the *Journal*.

If aphis has been found in the orchard, a thorough spraying with red oil emulsion, or one of the "prepared" red oil preparations on the market, should be given in July before the buds have expanded. Such a spraying will destroy over-wintering insects and eggs. One gallon of red oil is sufficient for 25 gallons of water. To prepare, dissolve 1 lb. of soft-soap in ½ gallon of water by boiling. Remove from the fire and add 1 gallon of the oil. Then churn the mixture for four or five minutes by pumping it through the spray-pump back into the bucket, thus creating a creamy, frothy emulsion, which should mix readily with soft water. If the water be hard it should be softened with about ½ lb. of washing soda to 25 gallons before diluting the emulsion. Before diluting, test the emulsion by placing a spoonful in a glass and filling with soft water. If oil rises to the surface the emulsion is not perfect, and the mixture should be heated and churned again. A little powdered soap assists the emulsifying process.

This process is somewhat troublesome, and growers generally use one of the prepared oils on the market, directions for mixing which are given on the tins.

Should the aphis be seen after the leaves have appeared, all affected trees should be marked with a strip of rag, and these should be sprayed with tobacco-water. Two applications should be given on the same day, the second application being necessary to kill insects that were only sickened by the first, and also to destroy any larvæ which may have been expelled by the dying insects. Experience has proved that two applications are much more effective, and therefore cheaper, than one.

As the spring advances, the insects breed much more rapidly, and these applications may have to be repeated several times on some of the trees. On no account should the insects be allowed to become numerous, as a badly infested tree is useless, and a danger to clean trees in the vicinity.

The following makes an effective tobacco spray:—Soak 1 lb. of leaf tobacco, or 4 lbs. waste tobacco, in 5 gallons of water for a week or longer. Strain, and add ¾ lb. of soft-soap dissolved in ½ gallon of water by boiling. ¼ lb. of washing soda added to the water used for soaking the tobacco assists in bringing out the strength. If required in a hurry, use boiling water and soak for 24 hours. The trouble of preparing tobacco-water may be obviated by using one of the tobacco extracts on the market.

Peach aphis, both black and green, cannot withstand hot winds, and generally disappear in November with the first hot, windy day, until the following winter.

Green Aphis.—This, like the black aphis, is a sucking insect; but, being the colour of the leaf, is not so readily noticed. It usually appears as soon as the leaves start to grow, and may be found on the expanding blossoms and on the under side of young leaves. As the leaves develop they curl up, thus forming cover for the insects; and it is impossible to spray so as to destroy them all. It is very necessary, therefore, to spray with tobacco-water as soon as the insects appear, and before many of the leaves have curled up, as the spray must come in contact with the insects to destroy them. The general treatment for green aphis is similar to that for black; but even greater care must be exercised by the grower to prevent the trees being badly infested. The curling of the leaf caused by green aphis is frequently mistaken for the curl-leaf disease caused by the fungus *Exoascus deformans,* and the wrong remedy applied.

San José Scale.—This is a very small, orange-coloured insect, with a black to slaty-grey scaly covering, and is the most destructive of the scale insects which attack deciduous trees.

The larvæ when first hatched out are very active, and run about in search of fresh wood; they soon settle down, and the scaly, nearly circular, covering forms. The insects remain in the same spot, and live by sucking the sap from the bark.

In the warmer districts of the State, their fecundity is enormous, and a tree which is comparatively clean in the spring may be smothered with the scales in the following autumn. A badly-infested tree looks as if it had been dusted with soot and ashes. It is not difficult to keep the pest in check, but in the warmer districts it is almost impossible to get rid of it completely once it has obtained a hold in an orchard. The most effective sprays are lime-sulphur and red-oil preparations. The lime-sulphur should be used in the winter at the rate of 1 gallon of lime-sulphur to 9 of water; but if the buds are swelling, the quantity of water should be 12 gallons. Red oil preparations vary, and the grower must be guided by the directions given by the manufacturer. If red-oil emulsion be prepared by the grower, 1 gallon of oil is sufficient for 25 of water. Very thorough spraying is essential in order to obtain good results, and two applications—one in the winter, and one in the early spring, before the buds have swollen much—are advisable.

Where San José scale and aphis are both present in an orchard, the oil spray should be applied about the second week in July, and a lime-sulphur application given (1 in 12) when the buds are swelling, as the latter spray, besides destroying scale, would prevent curl-leaf diseases, and the oil spray would be effective for scale and aphis.

Root Borer.—This is a native insect of the weevil family. The perfect insect varies from grey to brown in colour, and is about three-quarters of an inch in length, with a long proboscis, hence the common name of Elephant Beetle. It cannot fly, the wings being abortive. The injury is done by the larvæ of the beetle, a cylindrical, legless grub of a creamy-white colour. The eggs are laid on the leaves of the tree, or on weeds, and the grubs, when they hatch out, find their way to the roots, on which they feed, forming longitudinal channels along them. The grubs generally work at a depth of from one foot to four and even five feet below the surface; they are most likely to be found where there is a clay subsoil, and seldom on deep sandy soils. Affected trees usually show numerous dead twigs at the top, but sometimes only one limb may at first be affected, and this may die right back to the butt.

Trapping the beetles will keep the trouble in check; but the cost of examining the traps is so great that in the northern districts they have been discarded, and reliance is placed on thorough cultivation, heavy manuring, and ample watering. This treatment enables affected trees to keep forming new roots, which replace those injured by the grubs, until the tree is about eighteen years old, when it is usually worn out, and should be rooted up. The cheapest trap is made with a strip of hessian about 5 inches wide, and long enough to encircle the butt. The upper edge of this is fastened tight round the butt by a piece of thin wire, and another wire is run through the lower edge and fastened so as to hold it out from the butt, leaving a space of three-quarters of an inch between the butt and the lower edge of the hessian, forming a kind of crinoline. The beetles, when they emerge from the soil, crawl up the butt till they are stopped by the trap. In the spring and early summer, these should be examined four or five times a week, and the beetles found in them destroyed.

The female beetle deposits her eggs on a leaf, the two parts of which it folds together, or between adjoining leaves, which it joins with a gummy secretion. These, of course, should be destroyed when found, as well as all beetles found on the trees.

Rutherglen Fly.—The Rutherglen fly or bug, which occasionally causes immense damage to peaches and other fruits, is a small-winged insect about one-sixth of an inch in length. These pests generally attack fruit that is nearly ripe, congregating over the surface and sucking the juices by means of their rostra or beaks. The skin is toughened and rendered sticky and unsightly with the excretions. Such fruit is useless for marketing or canning, and the factories are now rejecting even slightly-affected fruit.

Perfectly green fruit is often attacked. As the insects are strong flyers, and in some seasons appear in immense numbers, they are very difficult to cope with. Spraying with soaperine, at the rate of 1 lb. to 5 gallons of water, will keep the insects off for a while; but the sprayings, to be effective, require so many repetitions that this treatment is not practicable in a commercial orchard. The insects are easily driven off by smoke, and good results are sometimes obtained by making a number of smudge fires through the orchard so that the wind will carry the smoke through the trees.

The whole of the orchard, including headlands, should be kept free from weeds, in which the Rutherglen bug breeds freely. The following mixture may be used with advantage on green fruit as a deterrent, but would taint fruit ready for marketing:—

Shred up a bar of yellow soap, and dissolve by boiling in water; add 3 lb. of washing soda, and make up to 40 gallons with water. To this add 1 quart of phenyle.

(To be continued.)

EUCALYPTS IN NORTH AFRICA.

Since the eucalyptus was introduced into Europe and North Africa, the merits of this Australian wood have been as much contested as praised, the reason for the difference of opinion being an absolute lack of method in the tests. Practically all the species introduced (about 100) have been confused with *E. globulus,* which is the best known one, and more absurd prejudices have been entertained than sound appreciations of the facts. It is now time to investigate the many uses of the wood of these trees, which grow admirably in the Mediterranean region, and which grow five times more quickly than the other indigenous or acclimatized trees.

The author has studied the acclimatized species of eucalyptus since 1875, and he is certain of their great value. In the present article, he draws attention to the red gums—those with red or pink wood.

These trees, now fairly common in the Mediterranean region, can be used for making very fine furniture, with the precise appearance and value of mahogany. Furniture makers are afraid to use this wood, as the public considers eucalyptus wood to be worthless. There is no reason for this prejudice.

The species of eucalyptus which can furnish red or pink wood like mahogany, and already commonly grown, are:—*E. rostrata* and a hybrid; *E. algeriensis,* which is the cross *E. rostrata* x *E. rudis; E. botryoides,* the pseudo-mahogany of the Australians, and a hybrid *E. botryoides* x *E. rostrata* = *E. Trabuti* Vilm; *E. terreticornis,* and its hybrids; *E. rudis; E. punctata; E. diversicolor.*

All these species are easily grown in North Africa; *E. algeriensis* has even become naturalized, and is often found growing on the banks of water-courses in a semi-wild state.

On account of the present exorbitant cost of furniture, it would be well worth while to give a better place to such a valuable wood, which can be produced easily and cheaply.—[From the *Report of the Meeting of the Academy of Agriculture of France,* Vol. VI., No. 1, pp. 37–39. Paris, January 7, 1920.]

THE APPLE ROOT BORER (*Leptops Hopei*).

Preliminary Report on Experiments with Explosives.

By C. French, Jun., Government Entomologist, and L. Pilloud, Orchard Supervisor.

The Apple Root Borer is probably the worst pest orchardists in Victoria have to contend against.

The female usually lays from 20 to 26 eggs on a leaf of the apple tree, and then folds the leaf over them as a protection. In a few days the eggs hatch, and the young larvæ enter the soil, and finding their way to the roots of the tree, commence to tunnel them. With the weakening of the roots, the tree assumes a sickly colour; later the tips of the twigs and boughs turn black, and the dying of the tree is only a matter of time.

Many experiments in eradicating the root borer have been made—bisulphide of carbon has been injected into the soil, and traps and zinc bands have been tried without any satisfactory results. Spraying with arsenate of lead has also been tried, and with some success.

Some years ago, Mr. G. Hill, of Ararat, experimented with explosives against root borers, and from the renewed growth of the trees the year following he formed the opinion that the use of explosives was effective for the purpose. Unfortunately, Mr. Hill left Ararat soon after without being able to confirm this conclusion by further experiments.

In order that a further test might be made, we arranged to carry out a series of experiments in an orchard at Pakenham, kindly placed at our disposal by Mr. Anderson, who assisted us in every way. Later, Mr. Anderson sold his orchard to two returned soldiers, Messrs. Stone and Brown, to whom we are indebted not only for permission to continue the tests, but for assistance they have given us.

The first experiment at Pakenham was carried out on the 23rd April, 1920. There were four holes, each 3 feet deep and 3 feet from the tree, and one plug of gelignite was used in each hole. Other experiments were carried out as follows:—

No. 1a. Tree. 2 holes, 2½ plugs in each hole, 3 feet from tree, 3 feet deep.—20.8.20.

„ 2. „ 1 hole, 3 plugs under tree, 3 feet deep.—23.4.20.

„ 3. „ 3 holes, 2 plugs in each hole, 3 feet from tree, 3 ft. 6 in. deep.—23.4.20.

„ 4. „ 3 holes, 2 plugs in each hole, 3 feet from tree, 3 feet deep.—23.4.20.

„ 5. „ 1 hole, 4 plugs in hole, 4 feet from tree, 4 feet deep.—23.4.20.

„ 6. „ 1 hole, 3 plugs in hole, 3 feet from tree, 3 feet deep.—20.8.20.

„ 7. „ 3 holes, 2 plugs in each hole, 3 feet from tree, 3 feet deep.—21.1.21.

„ 8. „ 4 holes, 2 plugs in each hole, 3 feet from tree, 3 feet deep.—21.1.21.

The Apple Root Borer.

1. Branch of tree with perfect insects showing female drawing leaves together. (Natural size.)
2. Larva (slightly enlarged.)
3. Pupa (Natural size.)
4. Eggs on leaves.

[Reproduced from *Handbook of the Destructive Insects of Victoria*, by C. French, senr.]

No. 9. Tree. 4 holes, 1 plug in each hole, 3 feet from tree, 3 feet deep.—21.1.21.
„ 10. „ 4 holes, 1½ plugs in each hole, 3 feet from tree, 3 feet deep.—21.1.21.
„ 11. „ 4 holes, 1½ plugs in each hole, 3 feet from tree, 3 feet deep.—27.5.21.

Root Borer traps were placed on Trees Nos. 1 and 2; only one beetle was caught. After the explosives were used the soil was removed from Trees 8 and 10, and no grubs were found. On digging away the soil from under No. 6 Tree, eight dead grubs were found.

No. 12 Check Tree on which Root Borer trap was placed, eight beetles were found in the trap.

No. 13 Tree was not treated with explosives, and on digging away the soil around the roots of the trees six live grubs were found.

Judging by the new growths on the trees and the new roots of the affected trees we are of the opinion that this means of treating the soil for the larvæ of the Root Borer will be successful, but before recommending its general use it will be necessary to continue the experiments for at least another year or two to see whether the size of the fruit increases and if the new growths remain healthy. The ground in which the experiments were conducted is heavy loam and stiff clay. The concussion from the explosives opens out the soil, which allows new root growth to appear.

The fumes caused by the explosions no doubt help to destroy any insect life in the soil, as cockchafers, wireworms, and other destructive insects were killed.

Messrs. Stone and Brown are so satisfied with the new growth of the trees dealt with that they have decided to treat all the affected trees in the orchard.

Cost of Material.

Gelignite, 9s. 6d. packet of 50 plugs.

Caps, 12s. per 100.

Fuse, 1s. 2d. coil.

For larger quantities—

Gelignite (case), 65s. per 10 packets.

Caps, 10s. per 100.

Fuse, same price, 1s. 2d. per coil.

The cost per tree, including gelignite, caps, and fuse, would be about 1s. 9d. This does not, of course, include labour.

LUCERNE EXPERIMENTS.

STATE RESEARCH FARM, WERRIBEE.

(*L. C. Bartels, B. Ag. Sc., Science Field Officer.*)

Perhaps the most notable feature of the agricultural development of Victoria in recent years has been the rapid increase in irrigation farming. Frequent demands are being made for extension of existing systems even by men who were originally opposed to the introduction of irrigation in their districts. Such requests have been refused because of the lack of water, and, although the schemes projected for storage will ultimately permit of very much greater areas being served, there will still remain much suitable land for which no water will be available unless steps are taken to use it economically. It is therefore of the greatest importance that investigations should be made into the methods of rationally and economically utilizing the supply available. The water requirements of irrigated crops, the effect of varying quantities of water upon growth, yield, and composition of crops, and the effect of varying frequency of application all require investigation. In other countries valuable work has been done giving guidance on such points as these, but, up to the present, practically nothing of a similar kind has been done in Australia. An area of 10 acres, however, has been set aside at Werribee for this purpose. The plots into which the area is subdivided were sown in September, 1919. Despite the adverse conditions prevailing at that time, the lucerne has made splendid progress, and the first results indicate that the experiments will give very interesting and valuable data when the records for a number of years have been obtained.

Investigations show that in irrigation farming the yield depends not only on the quantity of water applied, but on the time and number of the applications given. For most crops there is a very definite amount of irrigation water required for maximum yields—any quantity in excess is wasted, and may even diminish the return. Again, the value of the net returns may limit the best use of water to a quantity less than that which gives the maximum yield.

The endeavour of the irrigation farmer should be to maintain in the soil the proper quantity of water during the growth of the crop. He must irrigate intermittently, and the frequency of watering must be largely dependent on the quantity of water it is practicable to apply with minimum losses from evaporation and deep percolation.

Results, 1920-21.

"Rate and Frequency of Watering" Test.

This test was designed to determine the relation between the yield of lucerne and the varying quantities of irrigation water applied, as well as the frequency of the application. There are ten bays, one of which receives no irrigation water at all. The others receive varying quantities of water in different applications. For example, plot 1 receives 18 inches of water in six applications of 3 inches, while plot 2 receives 18 inches in three applications of 6 inches, and so on. The

first watering was not given until after the second cut had been removed; but the first two cuts were relatively heavy on account of the abundant spring rains. The late start in irrigating was due to the fact that the new concrete channels were not completed until December. Owing to this it was necessary to modify the original plan of watering. (The actual amount of water applied to each bay is set out in Table I. During the latter part of the season the watered plots showed up in marked contrast to the one receiving no water, and the whole series reflected the varying treatment. Generally speaking, there was an increased yield with increasing quantities of water; but with the heavier applications the extra yield was not proportional to the additional water applied. With smaller quantities of water it would appear to be of greater advantage to make frequent light waterings than to use the water in heavier applications.

The results obtained in this test are set out in Table I.

Table I.—Total Yield Per Acre—Five Cuts.

Bay.	Total Water Applied.	Number of Applications.	Total Yield per Acre.
	inches.		cwt.
1	12·2	4	119·8
2	12·4	2	113·6
3	16·0	4	126·6
4	18·0	3	128·4
5	15·6	5	127·3
6	..	..	71·6
7	18·4	3	135·2
8	20·2	4	132·8
9	23·7	4	146·6
10	29·7	5	153·4

Variety Test.

In the variety test an attempt is being made to ascertain the variety best suited to conditions similar to those obtaining at Werribee. Italian lucerne gave the highest yield, but, with this exception, Hunter River was the best. During the winter, Hunter River was very prominent, while Italian made but little growth. Grimm and Japanese were also very poor during the winter, but in the summer they produced a leafy hay with fine stems. South African approached most closely to Hunter River in regard to winter growth, and appeared to produce a better quality hay. French Provence did not make very good winter growth, but it yielded well during the summer, and gave hay of good quality. Patagonian gave some heavy yields. It appears to grow more slowly than Hunter River.

Table II. shows the yields obtained from the different varieties:—

Table II.—Variety Tests.

—	Variety.	Yield per Acre.					Totals.
		First Cut.	Second Cut.	Third Cut.	Fourth Cut.	Fifth Cut.	
		cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
1	Hunter River ..	36·3	21·3	25·9	18·7	8·8	111·0
2	French Provence	30·5	19·1	22·3	16·3	5·3	93·5
3	South African ..	37·1	19·6	22·4	16·1	4·6	99·8
4	Japanese ..	43·7	17·95	19·1	11·7	1·0	93·5
5	Peruvian ..	..	..	..	..	4·2	..
6	Hunter River ..	36·0	19·2	20·6	14·8	7·25	97·9
7	Salt Lake City ..	..	..	..	..	2·5	..
8	Spanish ..	..	..	..	..	5·2	..
9	Arabian ..	..	..	..	..	5·2	..
10	Turkestan ..	..	..	..	..	6·9	..
11	Hunter River ..	35·8	20·0	20·9	14·1	13·3	104·1
12	Patagonian ..	37·5	19·9	21·5	9·1	11·6	99·6
13	Persian	..	..	..	..	8·0	..
14	Grimm	36·5	20·7	24·2	17·2	13·6	112·2
15	Italian	43·4	27·33	28·0	22·2	15·8	136·7
16	Hunter River ..	44·0	25·7	23·8	23·2	18·3	135·0

"Time of Cutting" Test.

The object of this test is to determine the best stage at which to cut lucerne. There are three plots, each of which receives equal treatment in every respect, except in regard to the time of cutting. One plot is cut before any blooms appear, one when one-tenth of the plants are in bloom, and the third when in full bloom. From the "Cut before Blooming" plot six cuts were obtained; from the "Cut one-tenth in Bloom," five cuts; and from the "Cut in Full Bloom," four cuts. The results in the accompanying table show that the greatest yield was obtained from the plot on which the lucerne was cut when one-tenth in bloom. The quality of the hay at that stage is good, but it is not so fine as the hay obtained when cut before blooming. As the bloom develops, the lucerne deteriorates in quality, and when in full bloom the stems are coarse and woody, the leaves are dropping, and the shoots of the new crop are well forward.

For the first and last cuts of the season the percentage of bloom is not a very reliable guide as to the best time of cutting.

The results of this test are set out in Table III:—

Table III.—Showing Yields per acre obtained from various Plots in "Time of Cutting" Tests, 1920-21.

Cut.	Cut before Blooming.	Cut One-tenth in Bloom.	Cut in Full Bloom.
First	23·3 cwt.	21·1 cwt.	20·8 cwt.
Second ..	23·2 „	25·6 „	30·6 „
Third	15·7 „	28·6 „	27·0 „
Fourth ..	16·4 „	19·2 „	16·4 „
Fifth	12·3 „	13·7 „	.. ..
Sixth	13·7 „	..	..
Total ..	5 tons 4·6 cwt.	5 tons 8·2 cwt.	4 tons 14·8 cwt.

With a view to determining the nutritive value of the hay from the various plots, samples from each cut were analyzed. A summary of the results is contained in the following table:—

Table IV.—Showing the Average Analyses of the Hay from the various Plots, 1920-21.

——	Cut before Blooming.	Cut One-tenth in Bloom.	Cut in Full Bloom.
	%	%	%
Moisture	12·44	11·83	11·75
Ash	10·3	9·11	8·54
Protein	19·7	17·45	17·16
Crude Fibre	18·6	18·6	19·45
Carbohydrates ..	36·9	41·47	41·4
Fat	2·02	1·51	1·6

In reviewing the results from this test, particularly the analyses of the hay, one has to consider the effect of meteorological conditions on the plant. In the middle of the growing season the sunshine and warmth promote rapid growth, and there is not a great interval between the time when blooms begin to appear and when the lucerne is in full bloom. On the other hand, at the beginning and end of the season, the lucerne does not come into full bloom, and, in fact, in late autumn and winter the plant will grow, and wither, and then give place to new growth without any sign of bloom.

If moisture is abundant, only a small percentage of bloom appears, and, conversely, lucerne from which water is withheld will quickly go to flower. Again, a dense stand will show a smaller percentage of bloom than one sparsely grown.

Disregarding the slight differences in the moisture-content of the samples as shown above, the higher ash and protein-content of the hay from the "Cut before Blooming" plot point to the higher nutritive quality when cut at that stage. At the same time, the lower fibre-content, as compared with the hay "Cut in Full Bloom," is an indication of its higher digestibility.

It is obvious that investigations along the lines indicated will give interesting and valuable information, but the results for several years are necessary before any definite conclusions can be formed.

FARMERS' FIELD DAY AT THE RESEARCH FARM, WERRIBEE.

The annual Farmers' Field Day at the Werribee Research Farm was held on Friday, the 23rd September, when about 500 farmers and others from all parts of the State journeyed to Werribee by special train. Amongst those who attended were His Excellency the Governor (the Earl of Stradbroke), and his two sons, who had only that day arrived from England, the Director of Agriculture (Dr. D. S. Cameron), the Director of the Bureau of Science and Industry (Mr. G. H. Knibbs), Mr. J. Drysdale Brown, M.L.C., and Professor Woodruff.

In welcoming the visitors, the Assistant Minister of Agriculture (Mr. J. W. Pennington, M.L.A.), in a few sentences reviewed the history of the Farm, and said the desire of the Department was to undertake experiments that would be helpful to agriculturists in every part of the State. Of 2,200 acres, 150 were being devoted solely to scientific experiments. The cost of this experimental work was high and gave no monetary return, but the receipts from the remainder of the Farm had during the last three years been such that a profit on the whole Farm had been shown each year. For this achievement much credit was due to Mr. Richardson, who was undoubtedly the best man in Australia for the position of Agricultural Superintendent. Mr. Pennington said that departmental officers were always glad to consider suggestions for improving the usefulness of the Farm, and would also endeavour to give advice on agricultural matters to any farmer who sought it. If inquirers were dissatisfied with the expert's reply, then they should apply to him. (Laughter.) But he did not know whether they would care to act on his advice. (Renewed laughter.)

His Excellency the Governor then addressed the assemblage. He said the Field Day was the splendid opportunity for which he had been waiting, as it enabled him to get among the farmers of the State while they were walking round the Farm, and to exchange views and ideas on farming with them. The Old Land had lagged behind as far as the development of the scientific side of agriculture was concerned. Here, however, both the scientific and practical aspects were being investigated with results that were beneficial to the farmers. The experiments being carried out at the Farm showed the farmers what to follow and what to avoid. (Hear, hear.) The Field Day was a great opportunity for them to see the results of the investigations for themselves, and to take note of the practices that had been proved successful during the last nine years. He had previously inspected the Farm, and had been very much impressed with the Red Polled cattle. The breed was a very valuable one, in which he was himself deeply interested. Therefore he would say no more about them lest his listeners should think he was taking an unfair opportunity to give the Red Polls a boost. (Laughter.) While he was yet rather a newcomer among them to be giving advice, he felt there was one thing he could tell them. That was

to pay greater attention to the calves. They should be kept in forward condition right from the time of their birth, and the farmers should see that they did not lose the mother fat. In this way they could be kept in hand all the time and brought to early maturity, and they would be ready to turn into money at any time. The conditions here differed vastly to those in England, but it was noteworthy that there the wether sheep were not kept beyond the first year. They were brought early to maturity—a system that was necessary in order to get quick returns. The farmers in this State should aim at early maturity. Owing to the conspicuous place occupied by the wool-growing industry in Australia the day of the big stations was not quite ended, but as the country became more and more settled the farmers would have to get quicker returns from smaller areas.

Mr. Richardson then briefly touched on some of the results of experiments made in the rotation field, emphasizing the great disparity between the yields of the plot cropped with hay continuously and that on which hay was grown after bare fallow. The yield on land similar to that at Werribee from a crop of oaten hay on bare fallow would equal that from double the area on which hay was grown year after year. Thus the net profit from sowing hay after bare fallow was greater than that from twice the area cropped year after year, as in the former case only about half the expenditure was necessary for the same tonnage of hay.

From the rotation plots a visit was made to the irrigation field, where the various investigations that are being carried on in the methods of watering, fertilizing, grazing, and renovating lucerne were detailed by Mr. Richardson to an interested audience that stood round knee-deep in lucerne.

The Farm herd of Red Polls was seen on the way to the fertilizer trial plots. Dr. Cameron (Director of Agriculture), in the course of a short address, remarked that the herd had been founded twelve years ago by the purchase of thirteen cows and a bull. Since then 100 head had been purchased at different times. The present number in the herd is 120. During the past few years many bull and heifer calves had been sold on the basis of the dam's butter fat yield, and the amount expended in purchasing the herd had been got back, and £5,000 in addition. "I don't say to the Jersey breeder or to any other breeders that Red Polls are the best breed," said Dr. Cameron, "all I say is that results have proved them an excellent milking strain."

Some of the Farm flocks, which consist of Border Leicesters and Suffolks, were also seen, and Mr. Wilson (the Farm Manager) gave a short address on the sheep-breeding methods followed at the Farm.

The inspection of the manurial trial plots was then resumed, and the results of the numerous experiments seen side by side revealed how important is the part judicious fertilizing plays in the raising of profitable crops.

At the conclusion of the tour of inspection the visitors were entertained at afternoon tea. Afterwards some of the visitors inspected the farm buildings, others visited the poultry yards, while a few of the more enthusiastic agriculturists wandered back to have a further glance at some of the fertilizer trial plots.

THE INTRODUCED FLORA OF VICTORIA.

By J. R. Tovey, National Herbarium.

A weed has been described as "a plant growing out of its proper place." Since the "Weeds, Poison Plants and Naturalized Aliens of Victoria" was published in 1909, seventy-five species of plants have been recorded as having established themselves as naturalized aliens in Victoria; some of these have proved useful as pasture plants, but the majority are troublesome weeds. In addition, thirty-seven other exotics have been recorded, but these have not yet sufficiently established themselves to be considered naturalized. They, however, are liable to take the place of useful vegetation and should be suppressed.

Weeds are harmful and injurious in the following ways: They overpower the growing plants, and consume the mineral and other food elements, also the moisture essential to a growing crop, they harbor insects and parasitic fungi which attack growing crops; they prevent the proper cultivation of the soil, and may cause conditions which breed disease; they sometimes poison animals and man. The presence of weeds in a crop reduces its value considerably, whilst on pasture land they decrease its carrying capacity.

The seeds of most weeds are difficult to remove from the soil. On arable land weeds can be suppressed by clean cultivation coupled with hoeing, and the use of root crops, leafy fodder crops and rotation farming. On pasture land the cutting of weeds before they arrive at the flowering stage, and then burning them, aids in their suppression; but where the land is badly infested, it would be advisable to bring it under cultivation for a while, and then lay it down in pasture again.

The following is a list of plants which have not been previously recorded as growing wild in Victoria, and also records the further regional distribution of several introduced plants of this State:—

Bartsia viscosa, L., "Sticky Bartsia." (Scrophulariaceæ.)

Shire of Poowong and Jeetho, J. G. Duffy. January, 1921.

An additional locality in Victoria for this introduced plant. It is semi-parasitic on the roots of grasses, and is therefore injurious to pastures.

Carthamus glaucus, Bieb., "Glaucous Star Thistle." (Compositæ.)

Kowree Shire, H. R. Lamond, 26th January, 1921.

This plant, a native of Egypt, Asia Minor and Persia, has not been previously recorded as growing wild in Victoria, although it was proclaimed under the Thistle Act for the Shire of Kowree, August, 1918. It has spread largely in the above shire, and is generally accompanied with an allied species, *Carthamus lanatus,* L., better known as *Kentrophyllum lanatum,* D.C. "Saffron Thistle," by which name it was proclaimed under the Thistle Act for the whole State, but *Carthamus lanatus,* L., has priority, and that name must stand.

The "Glaucous Star Thistle," when not in flower, could easily be confused with the "Saffron Thistle." The flowers of *C. glaucus* are purple, whilst those of *C. lanatus* are yellow. The former has glaucous or slightly hairy stems, whilst those of the latter are more or less downy.

Cirsium syriacum, Gaertn., "Syrian Thistle." (Compositæ.)

Mansfield District, R. G. Dundas, January, 1921.

This thistle, a native of the Mediterranean regions, has not been previously recorded as growing wild in Victoria. It grows to a height of 4 or 5 feet. So far it appears to be confined to a limited area, but as it seeds freely it is likely to become a troublesome pest if allowed to spread. Cutting before seeding, piling, and burning will help to keep it down.

It has been proclaimed under the Thistle Act for the whole State.

Claytonia perfoliata, Don., "Perfoliate Claytonia." (Portulacaceæ.)

Glenlyon, Victoria, N. H. Ferguson, 3rd December, 1920.

An additional locality in Victoria for this plant. It is a native of North America, and was introduced into Victoria some few years ago with imported American fodder, and is now widely spread. So far it has not been considered a serious pest.

Eragrostis major, Host., "Stink Grass or Candy Grass." (Gramineæ.)

North-eastern District, March, 1921, per H. B. Payne.

This grass, a native of the tropical and subtropical regions, was recorded as a naturalized alien in Victoria in 1911. It is now widely spread in this State, and is plentiful in the North-eastern districts, also in New South Wales. It is a rather showy branched annual with erect or ascending stems 6 inches to 2 or 3 feet high.

The odour, emitted from the scent glands (Fig. 5) situated on the margins of the leaves, is particularly strong in the presence of dew or rain, and makes the plant objectionable to stock; hence it is usually avoided by them, except in the early stages of its growth.

It has sometimes been confused with *E. Brownii,* Nees, vernacularly known as "Common Love Grass," which is a native, perennial, and much superior grass.

Eragrostis major is easily distinguished from E. Brownii by its broader leaves, more compact panicle, stalked spikelets, the ring of short hairs forming the ligule, and the scent glands, which look somewhat like blunt teeth on the margins of the leaves, when examined under the microscope.

Gnaphalium candidissimum, Lam., "White Cudweed." (Compositæ.)

Growing on railway line at Lower Fern Tree Gully, C. French, junior, 10th February, 1921.

A native of South Africa; was first recorded as a naturalized alien in Victoria in 1906, and is now widely spread.

Stink Grass or Candy Grass, *Eragrostis major,* Host.

1. Whole plant. 2. Seed, slightly reduced. 3. Seed enlarged. 4. Leaf base and short hairs of ligule. 5. Portion of leaf, showing glands on edge. 6. Enlarged spikelet.

Hypericum Androsæmum, L., "The Tutsan." (Guttiferæ, sub-order-Hypericaceæ.)

Anderson's Creek, Mt. Beenak, J. W. Audas, 5th January, 1921.

An additional locality in Victoria for this introduced plant. It is evidently spreading towards Gippsland, where it will no doubt become a troublesome pest if unchecked. It is proclaimed under the Thistle Act for the whole of Victoria.

Lactuca scariola, L., "Prickly Lettuce." (Compositæ.)

Donald Shire, W. Cameron, January, 1921.

A native of Europe, recorded as a naturalized alien in the north-eastern districts of this State in 1913. It has now made its appearance in the north-west of Victoria. It has no economic value, but sheep will eat it down, particularly when the plant is young. On arable land, clean cultivation coupled with hoeing, &c., will help to suppress it.

Linum gallicum, L., "Yellow Flax." (Linaceæ.)

Growing on the railway line at Lower Fern Tree Gully, Victoria, C. French, jun., February, 1921.

This plant, a native of Europe, was first recorded as naturalized in Victoria in 1910. It is easily distinguished by its yellow flowers from the "Native Flax" (*Linum marginale,* Cunn), which has blue flowers. So far it has not been considered a serious pest.

Nicandra physalioides, Gaertn. "Apple of Peru." (Solanaceæ.)

Neerim, H. S. Wheeler, 29th February, 1912; Bruthen, C. C. Brittlebank. February, 1921.

This plant is a native of South America; it was previously recorded for the north-western portion of Victoria, and has now to be recorded as naturalized in the eastern part of the State. It is mentioned in Bentham's *Flora Australiensis,* Vol. IV., p. 465 (1869), as growing wild in New South Wales. Being an annual, seed formation can easily be prevented by close cutting or hand pulling while the plant is in early bloom.

Ononis arvensis, L., "Restharrow." (Leguminosæ.)

Woodend District, per W. A. N. Robertson, B.V.Sc., January, 1921.

This weed, a native of Europe and Asia, was previously recorded as a naturalized alien in the south-west portion of Victoria only. It is a shrubby plant with deeply descending roots, and hence becomes troublesome if allowed to establish itself firmly on the soil, but in its first year it is easily destroyed by ploughing and clean cultivation. Small patches could be dug up, piled, and burnt.

Oxalis purpurata, Jacq., "Purplish Wood Sorrel." (Oxalidaceæ.)

Langwarrin, Victoria, C. Coleman, 9th January, 1921.

An additional locality in Victoria for this weed. It is a native of South Africa, and has now evidently established itself as a naturalized alien. It is very difficult to eradicate owing to its bulbous roots.

Salpichroa rhomboidea, Miers, "Pampas—Lily of the Valley." (Solanaceæ.)

Black Rock, E. J. Semmens, January, 1916, and Roy McDonald, December, 1916; Burnley, J. W. Audas, January, 1918; Camberwell, C. French, jun., March, 1919.

A native of South America, which is apt to become a pest if allowed to spread. It was erroneously recorded as *Withania somnifera,* Dunn, in the Proc. Roy. Soc., Victoria, Vol. XXXI., p. 377 (1919), which is quite a distinct plant, and is not growing wild in Victoria.

Viola odorata, L., "The Violet." (Violaceæ.)

Growing in bush land between Drouin and Longwarry, Gippsland, Victoria, C. French, jun., September, 1920.

This well-known garden plant is a native of Europe, Asia, and Africa, and is now found growing wild in many parts of Victoria, having escaped from cultivation.

STEAM STERILIZATION OF SEED BEDS FOR TOBACCO AND OTHER CROPS.

Important Considerations.

Sterilization so improves the soil conditions that less fertilizer is necessary than on unsterilized ground. One should exercise caution against reinfecting the soil by walking on the steamed bed, using infected rakes, water from stagnant ponds, a solution of manures, or seed sown with unsterilized vegetable matter, such as decayed wood, punk, or decomposed leaf tissue. Finely-sifted, raw bone meal, thoroughly sterilized punk, and land plaster, are excellent materials for spreading the seed. They should be very slightly moist to spread well between the fingers and to retain the seed in the mixture. Root-rot is found in some seed beds that have been thoroughly steam sterilized. Such infection may have been carried by fertilizers applied after the steaming, by decayed vegetable matter used to spread the seed in sowing, or by contamination with adjoining diseased soil if the bed has not been kept covered after having been sterilized. Diluting material, like punk, can be readily sterilized at the time of steaming the soil by placing it in a bucket inserted under the pan, or it may be kept in the oven of a kitchen for several hours at a moderate temperature.

The seed may be safely sown twelve hours after the steaming of the beds. Dry seeds only should be used. There is a temporary injurious action in the soil after steaming which retards the growth of the young plant for ten to fourteen days, and sometimes longer. Sprouted seed is more readily injured by this temporary effect of steaming, but when dry seed is sown the effect has largely disappeared when the first shoots appear. This condition may sometimes retard the development of the plants appreciably during the first three weeks after sowing, but this is followed by a decided stimulating action, so that plants in sterilized

beds are usually ready for setting two weeks earlier than plants on unsteamed beds.

Steamed seed beds require much more water to produce a crop of seedlings than untreated seed beds. The surface soil is inclined to dry or crumble, and because of this tendency it is advisable to locate the seed beds near an easily available water supply. During clear, bright weather the beds should be inspected late in the morning and again in the middle of the afternoon, as the soil is very likely to dry out, killing young seedlings. Because steamed soil requires larger quantities of water the tendency is to over water. In this, care must be used, especially if the beds are sown rather thickly, since there is danger of the occurrence of damping-off under certain conditions. It is an advantage to keep the seed beds occupied after the tobacco plants are taken off. Steamed beds are especially adapted for growing late vegetable crops, which practice tends to keep the beds free from weeds.

The Formaldehyde Method of Sterilizing Seed Beds.

When steam sterilization cannot be used, formaldehyde may be employed to control seed-bed diseases. One gallon of commercial 40-per-cent. formaldehyde solution is diluted in 50 gallons of water. This solution is applied at the rate of 2 quarts per square foot of seed bed, using a common sprinkling can.

The seed bed should be prepared for sowing, and to do the most effective work the soil should be dry enough to absorb all of the formaldehyde solution. To prevent the ashing of the soil, the necessary quantity should be put on in a number of applications at intervals of, say, 20 to 30 minutes. When all the solution is absorbed the bed should be covered with blankets for 24 hours to confine the fumes. It should then be aired for eight to ten days to allow the escape of the fumes from the soil. The seed should not be sown so long as there is a trace of the formaldehyde, for this will kill the germinating seed or young seedlings.

The use of formaldehyde is recommended only when steam sterilization is not practicable. Its cost is greater than the cost of steaming, and it is usually less effective.

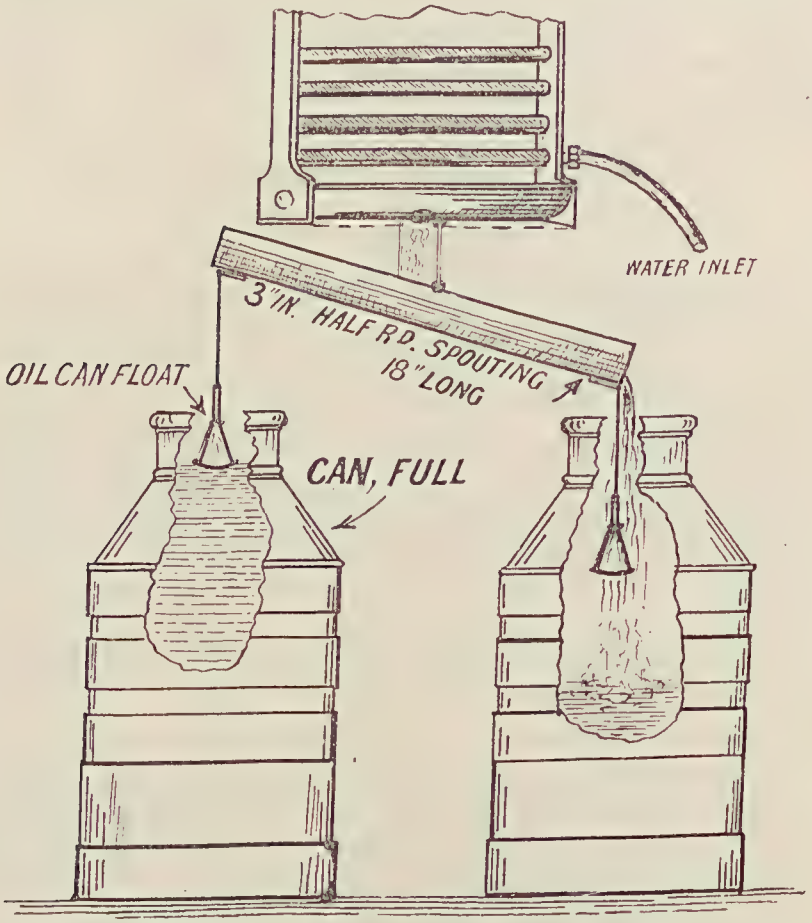
Application of the Steaming Process to Crops other than Tobacco.

The steaming of greenhouse soils with coils of pipes embedded therein had been practised for a number of years prior to the development of the inverted pan method of steaming as applied to tobacco seed beds. Since its adoption on tobacco seed beds the inverted-pan method of steaming has been demonstrated to be effective for greenhouse work, and, further, it is easily seen that the method can be applied to hot-beds and cold-frames for various other crops. It is especially valuable in the production of vegetable crops where it is desired to control damping-off and other fungous diseases which may be in the soil. The special requirements for any particular situation will readily suggest themselves, and the apparatus described for tobacco seed beds can be easily modified in size and shape of pan and arrangement of piping to suit almost every condition of soil steaming in green houses, outside frames, or even open fields.

—*Western Tobacco Journal*, Cincinnati, U.S.A., 28th March, 1921.

AN INGENIOUS MILK-COOLING ATTACHMENT.

If milk is to be travelled any distance before going into consumption, it is most essential that it should be cooled to as low a temperature as can be arranged immediately it is drawn from the cows. This is usually effected by passing cold well or spring water through a metal cooler while the milk is flowing over its outer surface. Several types of coolers are obtainable for this purpose, and providing there is an ample supply of cold water the process is very simple. The water



is piped to the cooler under pressure from some overhead or other supply, running in at the bottom of the cooler and leaving it at the top, and being carried away again by piping to, perhaps, another well, to the stock trough, or to the garden, according to the requirements of the farm.

In order to save time and facilitate the despatch of the milk this cooling is usually done while the milking is in progress, the milk vat above the cooler being re-filled as the cans or buckets of milk are brought to the cooling room from the milking shed. This allows of

the cooler working constantly until the last of the milk has passed over it; so that, where the water supply is sufficient and the flow regular, the dairyman's only trouble is to see that the receiving can below the cooler does not overflow, and milk be wasted before he returns from the shed with another lot of milk. An ingenious, yet simple, contrivance to obviate this possibility has been made by Mr. J. M. Kerr, of Brooklyn. It works most satisfactorily, and he has kindly permitted a description of it to be reproduced here for the benefit of others.

A piece of half-round three-inch tinned spouting about 18 inches long, and open at both ends, is suspended by wiring it on even balance directly below the milk outlet at the bottom of the cooler. On the lower side of each end of this, and not more than an inch from the end, is soldered a flat tin loop about ½ inch long, which will just carry a piece of baling wire. From each of these loops at a right angle is hung a float, made from a small oil can, to which is soldered a short piece of baling wire just sufficient to allow that when the milk can is full the float, with its wire attachment, will raise that end of the spout to rather more than level. This will turn the flow of milk from a full can at either end of the spout to an empty one at the other as required, providing that the float has been left hanging inside the empty can awaiting its turn to come into action as the other can fills. The arrangement illustrated completely does away with any anxiety as to possible overflow; for, at his or her return to the cooling room, each full can is always replaced with another empty one by whoever is in charge.

CHICORY.

Chicory (*Cichorium intybus*) is a perennial plant grown mainly for its roots which, after roasting and grinding, are used as an adulterant in coffee. In some regions it is also grown as a fodder crop. There are several varieties in cultivation, the commonest being Brunswick and Magdeburg. Being a perennial and with a long tap root, chicory is liable to become an objectionable weed if escaped from cultivation.

Climate.

The climatic requirements of chicory are somewhat similar to those of sugar beet, temperate regions with a good summer rainfall being most suitable for its cultivation. At present the chief centres in Victoria for the production of chicory are French Island, Phillip Island, and Hastings.

Soils.

Prefers a deep, free, easily-worked sandy loam with an open and well-drained subsoil. Will also grow well on poorer soils; but, owing to the very high costs per acre involved in raising this crop, it would be inadvisable to attempt its cultivation on any but the most suitable soil. As a good tap root is desired the plant must be able to root deep so that

waterlogged areas and soils with an impervious hard pan near the surface are unsuitable unless such faults are corrected.

Preparation of the Seed Bed.

The land should be ploughed as deeply as possible in August or early September, and then harrowed down to a very fine tilth, resembling an onion bed. As the seeds take some four or five weeks to sprout, it is necessary that the land should be very clean, otherwise weeds are liable to overtop or smother the young plants.

Seeding.

The most suitable time for sowing in Victoria is usually during late September or October. The seed should be sown in drills 16 to 18 inches apart, and as shallow as possible, not deeper than ½ to ¾ of an inch. About 1 to 1½ lbs. of seed per acre will be required.

When the plants are an inch or so in height they should be carefully thinned out in the drills, one plant being left to about every 5 or 6 inches. As soon as weeds appear, hoeing must be commenced. During summer weeds are kept down and the surface of the soil kept loose by means of the wheel or hand-hoe. The hoeing should be quite shallow, only deep enough to lift the weeds and loosen the surface. No cultivation is given after March.

Manures.

Like other root crops, chicory responds well to potassic and phosphatic fertilisers so that heavy dressings of potash and superphosphate will give greatly increased yields. Nitrogenous manures tend to develop the leaves at the expense of the roots and should therefore be avoided.

Harvesting.

The crop ripens about July, but digging usually starts in May on account of the time taken to harvest the crop, one man being able to lift an acre of roots in about ten days. The method of lifting usually employed is to run a light furrow along each row, thus exposing the roots, which may then be dug out with strong forks and laid in rows. The next process is "topping," the green tops being cut off with a sharp knife, and the roots thrown into heaps. The "tops" are much relished by stock, and are preferred to any other kind of forage. The roots are then thoroughly washed either in wooden vats or revolving root-washing machines. To dry the roots it is necessary to cut them into the thinnest possible slices, after which they are slowly dried in special "chicory kilns."

The average return of dried chicory on Phillip Island is, approximately, 1 ton per acre, though some growers have secured as much as 3 tons of dried chicory. To obtain such a yield, 11 tons of green roots are required.

As the local market for dried chicory is a limited one, intending growers would be well advised to make some arrangements with the merchants to take their crop at a fixed minimum price before committing themselves on a large scale.

THE MAKING OF CONCRETE FLOORS, POSTS, &c.

By J. W. McKenzie, Dairy Supervisor.

The making of concrete for cow-shed and pigsty floors calls for no particular skill. A careful choice of material and the mixture thereof are the principal factors in securing satisfactory results. The main ingredient in concrete is, of course, gravel or crushed stone. Care must be taken to see that this is free from earth or vegetable matter. The sand especially should be carefully chosen, and may be tested for cleanliness by placing a small quantity in a glass of water. Should the water be much discoloured it is evident that the sand requires further washing. In mixing the material use two and a half times as much sand as cement, and five parts gravel or crushed stone. The small chippings from a stone crusher, together with the finer crushed stone which is used for "blinding" macadamized roads is, because of the clean sharp edges, the very best material obtainable.

In putting down a floor the earth should be cleared away so as to allow the concrete to be laid to a depth of 4½ inches. The lower 2 inches may be composed of 2-in. metal mixed with sand and cement, with sufficient water added to produce a jelly-like mixture. The cement and sand must be first thoroughly mixed dry, and the stone after being wetted should then be added, together with sufficient water to secure the desired consistency. The water can be best applied through the fine rose of a watering can or garden hose. Much smaller stone or gravel should be used to within half-an-inch of the surface, and the remaining half-inch should be composed of sand and cement in the proportion of 2 parts sand to 1 of cement. After the floor is completed, and before it sets, if the surface be sligthly roughened by a very light application of the garden rake, cows will obtain a secure foothold, and falls will be avoided. A fall of one inch from the bail to the gutter at the rear of the cow will provide for efficient drainage. A concrete floor should be given ten days to set.

Experience and confidence gained by the laying of a floor as outlined above will in itself be valuable, and may be a stepping-stone to undertakings of a more difficult nature, such as the erection of buildings, and the making of such articles as pig, and other stock troughs, fence posts, &c. In the construction of all these only very fine gravel or stone—in conjunction with the sand and cement—should be used.

To facilitate the making of fencing posts, a hardwood mould should be made with a capacity according to the size of the post required. For ordinary fence posts a mould having sides 5 inches deep and 7 inches wide, tapering to 4½ inches at the top, and of the required length, will be found satisfactory. The mould, which is made with sides and ends, but without a bottom, is placed on a plank, and the material is then shovelled in. To give extra strength, and to make a thoroughly reliable job, a couple of pieces of 12-gauge barb wire the length of the post should be embedded lengthwise in the mixture when the mould is half full. The mould may then be filled up and levelled off by drawing a piece of hoop-iron along the top. The holes to accommodate the fencing wire are made by inserting wooden pegs, which, when the post commences to set, may be removed. The post should be allowed to remain

in the mould until it can be removed without risk, and then placed in a shaded spot to thoroughly dry.

Best results with concrete construction is obtained in cool weather, as rapid evaporation causes cracking. Evaporation may, however, be retarded by keeping the newly laid surface covered with wet sacks for a few days.

THE FIRST CREAM SEPARATOR IN AUSTRALIA.

We are indebted to Mr. Geo. Payne, jun., of Alexandra, for the accompanying picture of an old-fashioned De Laval Separator, which is believed to be the first separator imported into Australia. It was brought to Victoria in the year 1883 by Mr. William Nicolson, of the Crystal Creek Flour Mills, near Alexandra.

The machine is now in the Melbourne Museum, to which institution it was presented by Mr. Payne.

STALLION REGISTER, 1921-22

under the "Horse Breeding Act 1919."

(Part I.—Registrations Prior to 17th August, 1921.)

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
37	Abbey	A	Light ..	Harricks Bros. ..	Ararat
403	„ Dale ..	3	Draught ..	Wm. Malone ..	Walpeup
483	„ Mack ..	A	Light ..	T. Shearwood ..	Dooen North
484	Abdulla King ..	A	Pony ..	E. Stevens ..	Longwood
435	Active	A	Thoroughbred	G. Brown ..	Bennison
294	Admiral Moray ..	6	Draught ..	T. J. Keogh ..	Jarklin
293	„ Speary ..	A	„ ..	C. Hill ..	Gama
38	„ Sperry ..	A	„ ..	Alex. Duff ..	Baringhup
481	„ Wood ..	A	Light ..	A. G. Hunter ..	Elmore
324	Advance	A	„ ..	L. C. O. Smith ..	Merbein
485	„	6	Draught ..	F. and E. Huf ..	Hopetoun
482	Alex. R.	A	Light ..	C. L. Lutze ..	Long Plain
486	Al Borak	A	„ ..	T. McCarthy, jun.	Merbein
488	Alister	A	„ ..	J. Williamson ..	Newry
490	All Green	A	Thoroughbred	R. Biggar ..	Waaia
39	„ Scotch ..	6	Draught ..	J. Elliott and A. Dickens	Tatura
24	„ Style	A	Light ..	R. Matchett ..	Bendigo
441	Almont Rose ..	A	„ ..	P. Dermondy ..	Dunolly
40	Almont's Pride ..	A	„ ..	Downie Bros. ..	Longwarry Sth.
41	Angle Jack ..	A	„ ..	C. F. Hillas ..	Tallangatta
295	Argyle	A	Draught ..	F. McRae ..	Wallup
489	„	A	Pony ..	R. Trimble ..	Rutherglen
175	Aristocrat ..	A	Light ..	R. Price ..	Wallacedale Sth.
42	Assembler ..	5	Pony ..	G. W. Horne ..	Lal Lal
487	Athlete	4	„ ..	J. Lane ..	Armadale
43	Avonlea	6	Draught ..	Jas. Leitch ..	Wodonga
491	Bally Golly ..	A	Pony ..	F. C. Maidment ..	Moyston
4	Bannockburn ..	6	Draught ..	G. W. Francis ..	Lower Norton
177	Barbour 2nd ..	A	„ ..	J. Richardson ..	Berriwillock
104	Baritone	3	„ ..	E. McKoy ..	Wodonga
315	Barney II. ..	A	Pony ..	A. W. Thomson	Hamilton
492	Baron	A	Draught ..	M. P. Murphy ..	Rupanyup
471	„ Again ..	4	„ ..	A. Gillis ..	Newmarket
45	„ Asquith ..	A	„ ..	D. L. Bodey ..	Jung
314	„ Blaze ..	2	„ ..	C. C. Mengler ..	Linga
224	„ Ettrick ..	2	„ ..	A. Colvin ..	Nathalia
46	„ Faithful ..	6	„ ..	D. Barry, jun. ..	Culgoa
47	„ Fenwick ..	A	„ ..	A. J. Richards ..	Strath Creek
493	„ „ ..	A	„ ..	H. C. Wilson ..	Raywood
267	„ Juno ..	A	„ ..	W. T. Manifold	Camperdown
226	„ Kelvin ..	3	„ ..	A. Gillis ..	Newmarket
22	„ Laddie ..	A	„ ..	A. McLennan ..	Derrinal
172	„ McKie ..	A	„ ..	J. A. McDougall	Cosgrove
48	„ McLean ..	A	„ ..	D. W. Stewart ..	Logan
389	„ Majestic ..	5	„ ..	A. Colvin ..	Nathalia
49	„ Milford ..	A	„ ..	J. Johnstone ..	Lubeck
50	„ Minto ..	A	„ ..	Wm. Hermiston	Mansfield
217	„ Ramsay ..	5	„ ..	P. Sullivan ..	Nth. Melbourne
228	„ Seal ..	2	„ ..	A. Gillis ..	Newmarket
223	„ Silk ..	3	„ ..	J. H. Meyer ..	Kaniva
178	Baron's Heir ..	A	„ ..	T. J. Hansen ..	Barnawartha
269	„ Pride ..	A	„ ..	V. J. Lanfranchi	Cowangie

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
394	Baron's Pride ..	A	Draught ..	J. H. McGrath ..	Tatura
398	,, Reserve ..	A	,, ..	E. J. McCabe ..	Gerang
494	,, Royal Chief	A	,, ..	T. E. Parry ..	Coonooer Bridge
51	Baron Stanley ..	A	,, ..	Graham Bros. ..	Bacchus Marsh
52	,, Stewart ..	6	,, ..	J. W. Hansen ..	Baulkamaugh
495	,, Twist ..	A	,, ..	E. and W. Ham	Lockington
268	,, Watson ..	A	,, ..	W. T. Manifold	Weerite
53	,, Wattee ..	4	,, ..	F. Nagorcka ..	Tarrington
54	Barony	A	,, ..	E. C. R. Spedding	Bealiba
496	Basil B.	A	Light ..	W. A. Riedell ..	Tongala
399	Battarlons ..	A	Draught ..	T. Skelly, jun. ..	St. Arnaud
171	Bawnmoor ..	A	Thoroughbred	W. J. Byrne ..	Sea Lake
313	Beau Cheval ..	A	Light ..	T. Garland ..	Wodonga
497	Beechwood ..	A	Thoroughbred	H. C. Owens ..	Laverton
101	Belmont's Champion	A	Draught ..	Goss Bros. ..	Donnybrook
498	Bell Boy	A	Light ..	A. G. Turnbull ..	Horsham
75	Berkeley Bantam ..	5	Pony ..	R. Crozier ..	Sth. Morang
499	Berra Bach ..	A	,, ..	Bryce and Dunn	St. Arnaud
500	Bickie	A	Light ..	A. G. Turnbull ..	Horsham
404	Black Prince ..	A	Pony ..	Thos. Gaudie ..	Thoona
55	,, Tom ..	A	Light ..	A. Potter ..	Naroghid
98	Blacon	A	Draught ..	Jas. Wilson ..	Ocean Grove
3	Blair Lad ..	3	,, ..	A. Gillis ..	Newmarket
225	Blair's Choice ..	3	,, ..	Keam Bros. ..	Glenlea
56	Bobniak	A	Light ..	H. F. Clarke ..	Miepoll
234	Bobrikoff	4	Draught ..	G. Burrows ..	Care of Adamson, Strettle
57	Bold Action ..	6	,, ..	E. Pearce ..	Rupanyup
34	,, Agitation ..	A	,, ..	J. E. Edes ..	Kensington
32	,, Alex. ..	5	,, ..	McClelland and Gillett	Lara
233	Bold Briton ..	6	,, ..	C. A. Schulz ..	Lake Hindmarsh
157	,, MacGregor ..	A	,, ..	W. McNaughton	Walpeup
405	Bonnie	4	Pony ..	Wm. Chynoweth	Swan Hill
176	,, Scotchman	A	Draught ..	R. Price ..	Wallacedale Sth.
58	,, Wizard ..	6	Pony ..	W. Morey ..	Katandra North
179	Booringa	A	Light ..	T. J. Hansen ..	Barnawartha
59	Boro' Albert Victor	A	Draught ..	J. A. Cuthbert ..	Congupna
270	,, Cashier ..	A	,, ..	K. A. Domaschenz	Rainbow
60	Bramhope Forester	A	,, ..	E. Parish ..	Horsham
61	,, Paladin	A	,, ..	W. H. Alford ..	Modewarre
348	,, Samson	A	,, ..	A. Dean ..	Tinamba
461	Breadwinner ..	A	Light ..	Ed. Prime ..	Echuca
446	Breastknot ..	A	Draught ..	W. J. Moll ..	Dimboola
10	Bright Star ..	A	Pony ..	J. J. Simkin ..	Chetwynd
62	Brookdale ..	A	Draught ..	J. T. Poynton ..	Ensay
462	Buchlyvie's Choice ..	6	,, ..	W. J. Westerndorf	Winiam
63	Bundoran ..	A	Light ..	A. Graham ..	Bacchus Marsh
180	Caledonian ..	A	Draught ..	Withers Bros. ..	Bobinawarrah
440	Canary's Pride ..	A	Pony ..	Mrs. M. A. Jones	Speed
271	Cannonite ..	A	,, ..	J. C. H. Greaves' Estate	Mansfield
406	Canny	4	Thoroughbred	T. A. Griffiths ..	Glenrowan
402	Cape Sky	6	,,	G. Buckley ..	Wickliffe
64	Captain Llewellyn ..	A	Light ..	H. Bullock ..	Hamilton
181	Carden	A	,, ..	W. H. Penaluna ..	Boolarra
65	Carwelkin ..	A	Pony ..	T. Spillane ..	Williamstown

Stallion Register, 1921–22—*continued.*

Cert No.	Name	Age	Class.	Owner.	Address.
		Yrs.			
456	Cedric's Son ..	A	Draught ..	D. Caldow ..	Piangil
9	Chal	5	Thoroughbred	T. J. Scott ..	Everton
320	Chidley	A	Pony ..	Executor late W. E. Mitchell	Corryong
66	Cicero	A	Draught ..	R. Lloyd ..	Kyabram
407	Clansman	2	,, ..	Thos. Cameron ..	South Bundalong
152	Claymore	A	,, ..	J. R. Stokes ..	Abbotsford
67	Clem	A	Pony ..	M. Skeyhill ..	Weerite
408	Clyde Brae ..	2	Draught ..	Walder and Sons	Watchem
68	Colonel Dale ..	A	,, ..	T. F. Major ..	McMillans
69	Commander ..	A	,, ..	A. Simon ..	Huon
263	Commodore Nut ..	A	Pony ..	W. T. Manifold	Weerite
70	Commonweal ..	A	Draught ..	W. C. Holt ..	Foster
71	Commonwealth ..	A	Light ..	S. Mathieson ..	St. Helens
342	Contractor	A	,, ..	J. T. Ovens ..	Cooma
143	Crest of the Wave ..	A	Thoroughbred	J. L. Smith ..	Mernda
129	Crown Derby ..	A	Draught ..	W. S. Graham ..	Tongala
477	,, Jewel ..	A	,, ..	Kuhne Bros. ..	Rainbow
72	,, Steel ..	A	Thoroughbred	E. Raffelt ..	Banyena
476	Cyanide	A	Pony ..	W. J. Reddick ..	Woorara
73	Cyndett II. ..	A	,, ..	G. J. Marshall ..	Coalville
409	Dalbora	3	Draught ..	W. Bunworth ..	Watchupga
21	Dalmeny	A	,, ..	A. J. Ritchie ..	Arawata
411	Dalmore's Pride ..	3	,, ..	R. G. Hynam ..	Patchewallock
74	Dandy Again ..	A	Pony ..	A. Cameron ..	Warracknabeal
412	,, Direct ..	3	Light ..	G. R. Wilkinson and R. M. Graves	Manangatang
76	,, Duke ..	A	Pony ..	Kong Meng Bros.	Longwood
156	,, Junior ..	A	,, ..	R. F. Carmody ..	Everton
455	,, Lad ..	A	,, ..	Stuckey Bros. ..	Flynn's Creek
77	Dandy's Pride ..	A	,, ..	P. V. Francnfelder	Wodonga
78	Dawn of Hope ..	A	Draught ..	L. D. Murray ..	Glenlyon
272	Defender	A	,, ..	J. Ballantyne ..	Buln Buln
183	Delavan Junior ..	A	Light ..	M. E. McMurtrie	Albert Park
79	Demolition ..	A	Thoroughbred	A. R. Tink ..	Kaniva
80	De Wet	A	,,	Ed. Land ..	Oxley
81	Dick Alto ..	A	Light ..	W. J. Banner ..	Irymple
82	Digger	A	,, ..	R. Dunbar ..	Harston
83	Digitalto	A	,, ..	Ed. Cuthbert ..	Camperdown
146	Dillon Bell ..	A	,, ..	S. J. Lewis ..	Parker's Plains, Baringhup
216	Direct Lulu ..	A	,, ..	J. F. Mitchell ..	Burrowye
84	Director	A	,, ..	G. E. Marshall ..	Dunolly
23	Directway ..	A	,, ..	R. Matchett ..	Bendigo
12	Dixie Boodle ..	A	,, ..	A. M. Pitman ..	Clifton Hill
85	Doctor	A	Pony ..	J. B. Cleeland ..	Newhaven
182	Don Abbey ..	A	Light ..	M. E. McMurtrie	Albert Park
413	Donald's Best ..	4	Draught ..	D. Kelly ..	Kunat
87	Don Olive	A	Pony ..	A. Checsley ..	Barnawartha
86	Donnibristle ..	A	Draught ..	Wilson Estate ..	Milawa
438	Douglas Chief	6	,, ..	F. W. Sallmann ..	Dimboola
163	Druce	A	Light ..	W. H. Williams ..	Tandarra
88	Drysdale	A	Draught ..	W. Crozier ..	South Morang
184	Duke of Melton ..	A	Light ..	Hoysted Bros. ..	Wangaratta
296	Dunsby's Pride ..	A	Draught ..	J. R. Baldwin ..	Gre Gre Village
89	Earlmont	A	Light ..	A. J. Snow ..	Stanhope

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
185	Electioneer ..	A	Light ..	G. J. Shaw ..	Yarram
90	Elksley Commander	A	Draught ..	J. Talbot ..	Coreen, N.S.W.
149	Eltham	A	Light ..	Mrs. C. Barr ..	Archdale
91	Emulator's Pride ..	A	,, ..	Wm. McArthur	Noorat
451	Ercildoon Dick ..	A	Pony ..	D. Gardner ..	Milawa
222	Everest Hero ..	4	Draught ..	C. A. Willmott ..	Trundle, N.S.W
92	Excel	A	Pony ..	W. C. Holt ..	Foster
221	Fabric Yet ..	4	Draught ..	Mitchell and O'Brien	Kirk's Bazaar, Melbourne
345	Fairhaven ..	A	,, ..	P. Smith ..	Mingay
93	Fashion's Model ..	A	,, ..	A. B. Hamilton	Fish Creek
94	Federal Tax ..	A	,, ..	J. T. Williams ..	Tandarra
95	Flash Donald ..	A	Light ..	John Morris ..	Curyo
96	Flowerdale ..	A	Draught ..	D. L. Bodey ..	Jung
410	Foamy Voyage ..	3	Light ..	A. V. Mahar ..	Kerang
97	Freedom	A	,, ..	J. Montgomery ..	Milawa
414	Friar John ..	A	Pony ..	Miss N. McKellar	Geelong
99	Futurist	6	,, ..	Sir R. T. H. Clarke	Lancefield Junction
401	Gallant Knight ..	A	Draught ..	H. R. Lee ..	Clunes
33	Gameolition ..	5	Light ..	J. W. Chace ..	Willenabrina
344	Garnet	A	Pony ..	D. A. S. Hutton	Penshurst
396	Gay Lad	A	Draught ..	J. Archibald ..	Sale
415	General Foch ..	5	,, ..	R. Williams ..	Tyntynder West
100	,, Keith ..	6	,, ..	T. Nunan ..	Nowie
106	,, Scott ..	A	,, ..	A. Strawhorn ..	Edgecombe
333	Gillies Son ..	A	,, ..	Boyd Bros. ..	Koroit
220	Glen Arthur ..	3	,, ..	Mitchell and O'Brien	Kirk's Bazaar, Melbourne
107	Glenmarkie ..	A	,, ..	John Cook ..	Rochford
108	Glenspean ..	A	Thoroughbred	A. Cameron ..	Warracknabeal
187	Golden Star ..	3	Draught ..	F. H. Baker ..	Jung
340	Goldenwood ..	A	Light ..	J. T. Ovens ..	Cooma
109	Gossoon Bells ..	A	,, ..	Wm. Leach ..	Rheola
391	Grampian Chieftan	3	Draught ..	F. H. Baker ..	Jung
110	Grattan Junior ..	A	Light ..	W. J. Parish ..	Horsham
111	Grey Marvin ..	A	,, ..	J. S. W. Uren ..	Krowera
112	,, Tod	6	,, ..	W. Williams ..	St. Arnaud
36	Gwalia Caesar ..	A	Pony ..	A. E. Hoadley ..	South Melbourne
449	Hafren Sensation ..	A	,, ..	Miss B. B. Reid	Bundoora
144	Halcyon	A	,, ..	Mrs. J. M. Maclellan	Windsor
437	Hambbletonian Direct	A	Light ..	R. S. Wright ..	Yarraberb
113	Handyman ..	A	Thoroughbred	H. F. Clarke ..	Miepoll
114	Happy Bells ..	A	Light ..	W. H. Bell ..	Beechworth Junction
173	Happy Vein ..	A	Thoroughbred	Fitzpatrick Bros.	Boort
30	Harold Wilkes ..	A	Light ..	Mrs. P. Shipp ..	Richmond
454	Harry Alto ..	A	,, ..	A. G. Hunter ..	Elmore
229	,, Dillon ..	3	,, ..	W. A. Smily ..	Perth, W.A.
29	Headwind ..	A	Thoroughbred	Moonee Valley Racing Club	Melbourne
273	Hercules	A	Draught ..	E. Storer ..	Wallacedale North
145	Hermes of Shetland Heights	A	Pony ..	Mrs. J. M. Maclellan	Windsor

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
474	Hero II.	A	Pony ..	Greaves Bros. ..	Yannathan
115	High Commander ..	A	Draught ..	Dean Bros. ..	Euroa
116	„ Degree ..	6	„ ..	J. Galloway ..	Majorca
117	Highland Fancy ..	A	„ ..	G. Hildebrand ..	Leitchville
118	Hillhead Knight ..	A	„ ..	R. E. Krause ..	Boolite
119	His Majesty ..	A	„ ..	M. Frawley ..	Leigh Creek
339	Hivites	A	Thoroughbred	F. N. Heywood	Toongabbie
7	Hoprig	A	„	R. F. Carmody ..	Everton
395	Invincible ..	A	Draught ..	J. F. Ryan ..	Bearii
120	Ipidi	A	Thoroughbred	Jas. O'Keefe ..	Shepparton
468	James Osterley ..	A	Light ..	F. R. Stiles ..	Mt. Moriac
121	Jock	A	Draught ..	G. T. Wolstenholme	Milawa
274	Joe Horner ..	A	„ ..	Murphy Bros. ..	Clydebank
13	Jolly Maltster ..	A	Thoroughbred	Department of Defence	Melbourne
275	Kelm Pride ..	6	Draught ..	R. Williams ..	Chinkapook
458	Kelmscott II. ..	4	„ ..	A. W. Lackman	Murrayville
262	Kelm's Pride ..	A	„ ..	J. Dugdale ..	Myrniong
346	King Albert ..	6	„ ..	G. Francis ..	Horsham
123	„ „ ..	A	„ ..	T. McKay ..	Malmsbury
400	„ Bally ..	A	Pony ..	Hugh Lee ..	Clunes
124	„ Clyde ..	6	Draught ..	T. O'Brien ..	Hopetoun
125	„ Duncan ..	A	„ ..	P. Leydon ..	Cooma
155	Kingling	A	Thoroughbred	Wm. McDonald	Dimboola
126	King of Clubs ..	A	Draught ..	M. Skeyhill ..	Weerite
127	„ Kings ..	A	„ ..	T. Christie ..	Woodend
276	„ the Valley	A	„ ..	C. J. Woodyard	Whitfield
349	King's Clydesdale ..	A	„ ..	W. J. Schmidt ..	Jeparit
338	„ Pride ..	A	„ ..	G. T. Hill ..	Baddaginnie
148	Kitchener ..	A	„ ..	Agricultural College	Dookie
128	Kola Mauritius ..	6	Light ..	J. A. Wilson ..	Kerang
130	Laddie o' Groat ..	5	Draught ..	W. H. Gillett ..	Lara
131	Latest Style ..	A	Light ..	M. Buckley ..	Romsey
132	Lee Creek Squire ..	A	Draught ..	A. K. Lange ..	Armytage
11	Leevialand ..	A	Light ..	A. Bickley ..	Sunshine
19	Lena's Abbey ..	A	„ ..	W. C. Greaves ..	Monomeith
133	Leonard	A	„ ..	H. F. Lovett ..	Corowa
134	Le Rosier	A	„ ..	E. Parish ..	Horsham
135	Limestone	A	„ ..	Ed. Miller ..	Ascot Vale
136	Linkwood ..	A	Draught ..	J. and T. Hamilton	Tatyoon
137	Lion Prince ..	A	„ ..	J. F. Hurley ..	Bobinawarrah
138	Little Billy ..	A	Pony ..	C. Pratt ..	Watchupga
162	„ Jim ..	A	„ ..	S. A. Reddie ..	Princetown
277	„ Lonsdale ..	A	„ ..	J. Neeson ..	Chetwynd
337	„ Wonder ..	A	„ ..	G. C. Roughead	Ruby
336	Loch Albyn ..	A	Draught ..	J. J. Moylan ..	Cosgrove
28	„ Allen ..	A	„ ..	J. R. Stokes ..	Melbourne
139	Locksley	A	„ ..	C. F. Schulze ..	Arkona
241	Lord Armadale ..	A	„ ..	H. Thomson ..	Newlyn
140	„ Bingen ..	A	Light ..	E. J. Janetzki ..	Jeparit
141	„ Chancellor ..	A	Draught ..	W. Flack ..	Daylesford
460	„ Jellicoe ..	5	„ ..	J. Frith ..	Nyang
27	„ Panic ..	A	Light ..	D. J. Hamer ..	Croydon
20	„ Percival ..	A	Draught ..	J. M. Fahey ..	Gnotuk
15	„ Pilatus ..	A	Thoroughbred	H. Agnew ..	Horsham
1	„ Welkin ..	5	„	W. and H. Carmichael	Swan Hill

STALLION REGISTER, 1921-22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
279	Lorryman ..	A	Draught ..	C. Baldry ..	Cosgrove
31	Loueen	5	Light ..	W. G. Anderson	Craigieburn
6	Loyalist	A	Draught ..	O. Gray ..	Wedderburn
151	Lucky Jim ..	A	,, ..	J. R. Stokes ..	Melbourne
280	Mahomet	A	Pony ..	A. Brown ..	Rupanyup
142	Mainstitch ..	A	Thoroughbred	F. E. Mackay ..	Violet Town
416	Major Clyde ..	3	Draught ..	F. R. Dardel ..	Corack East
159	,, Dale ..	A	,, ..	J. McDonald ..	Boort
160	,, Lawrence ..	A	,, ..	M. Parnell ..	Katamatite
417	,, Ribbonwood..	4	Light ..	C. S. Walker ..	Swan Hill
161	,, Style ..	A	Draught ..	T. J. Carson ..	Monbulk
418	,, Thornley ..	5	,, ..	T. Torpey ..	Turriff
164	Malacca	A	Light ..	Beattie Bros. ..	Tungamah
166	Mambrino Wilkes ..	A	,, ..	Wm. Grant ..	Camperdown
165	Maori Chief ..	A	,, ..	J. Caldow ..	Winchelsea
167	,, Jack ..	A	Draught ..	A. Potter ..	Camperdown
390	Marathon	A	Pony ..	J. G. Stewart ..	Hamilton
168	Markhope ..	A	Thoroughbred	Sir R. T. H. Clarke	Lancefield Junction
169	Marmaduke ..	A	Pony ..	A. J. Gillies ..	Noorat
170	Marshal Clyde ..	A	Draught ..	Jas. Nunn ..	Birchip
174	Master Brigham ..	A	Pony ..	A. E. Harding ..	Whorouly
312	,, Dix ..	A	Thoroughbred	Geo. King ..	Wodonga
335	,, Valve ..	A	Pony ..	A. Lang ..	Castlemaine
311	,, Wattee ..	A	Draught ..	Brock Bros. ..	Moe
419	McAgain	3	,, ..	W. G. Burns ..	Goroke
25	Melbourne Prince ..	A	,, ..	F. Shaw ..	St. Arnaud
8	Moira Lad ..	A	,, ..	C. R. Cunnington	Bamawm Ext.
219	Montrae Bold ..	4	,, ..	E. Don ..	Newham
309	Monty	A	Pony ..	W. H. Morris ..	Woolsthorpe
158	Moolap	A	Light ..	T. Mitchell ..	Durham Lead
463	Moving Picture ..	A	,, ..	W. Fisher ..	Yaapeet
308	Mountain Chief ..	A	Draught ..	J. M. Connelly ..	Birchip
444	Murundi	A	Pony ..	A. E. Bowman ..	Ebden
18	Mystery	A	Light ..	C. E. Fewster ..	Richmond
147	Napoleon	6	Draught ..	S. J. Lewis ..	Baringhup
480	Newfield's Baron ..	A	,, ..	R. A. Martin ..	Navarre
384	Newton Banks ..	A	,, ..	O. Shaw ..	Terang
16	,, Stewart ..	A	,, ..	A. H. Borgelt ..	Tarranginnie
188	Newton's Pride ..	3	,, ..	H. E. Cuttle ..	Cope Cope
382	,, Sensation	A	,, ..	H. H. Nairne ..	Tongala
380	Odd Patch ..	A	Light ..	G. H. Findlay ..	Almurta
381	Oakland's Pride ..	A	Draught ..	C. F. Dolan ..	Ouyen
282	Onward O ..	A	,, ..	E. Coward ..	Congupna
379	Orcwar	A	Light ..	T. J. Pratt ..	Colac
211	Oscar Asche ..	5	,, ..	M. Stephenson ..	Fitzroy
341	Ostrich II. ..	A	,, ..	J. T. Ovens ..	Cooma
283	O.Y.D.	A	,, ..	P. Lyon ..	Laanecoorie
212	Papakaio	A	Draught ..	A. C. B. Dripps..	Nathalia
378	Patchword ..	A	Light ..	H. Milte ..	Lascelles
377	Patriotic	A	Draught ..	H. L. Ferry ..	Buangor
376	Pearlyn	6	Light ..	F. W. Bowden ..	Won Wron
375	Peterhof	A	Thoroughbred	W. T. Rowe ..	Wallinduc
374	Pirateer	A	Light ..	D. McArthur ..	Victoria Valley
373	Plumlea	A	,, ..	P. Fischer ..	Jeparit
372	Plunkett's Pride ..	A	Draught ..	T. Crouch ..	Welshpool
230	Politician	A	Light ..	W. J. Wood ..	Moyhu

STALLION REGISTER, 1921-22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
235	Premier Again ..	4	Draught ..	G. Burrows ..	Melbourne
35	,, Jack ..	A	,, ..	J. Edes ..	Kensington
284	,, Massey ..	A	,, ..	H. R. Mullen ..	Terrick South
371	,, Montgomery of Willowbank	A	,, ..	H. H. Fletcher ..	Congupna
370	Preston	A	Pony ..	E. McEvoy ..	Colbinabbin
343	Pride of Lochiel ..	A	Draught ..	J. T. Ovens ..	Cooma
285	,, The Ponds	A	,, ..	Ed. Drayton ..	Waurn Ponds
369	Prince Aldie ..	A	,, ..	Brock Bros. ..	Moe
368	,, Alexander ..	A	,, ..	Trask Bros. ..	Warncoort
367	,, Bally ..	A	Pony ..	J. G. Bird ..	Yarram
366	,, Bells ..	6	Light ..	R. Youren ..	Natte Yallock
433	,, Charles ..	6	Pony ..	J. Dawkins ..	Colac
286	,, Charming ..	A	Light ..	Williams Bros. ..	Thornton
287	Queen's First ..	A	Draught ..	Kenyon Bros. ..	Lascelles
281	Ranfurly	A	,, ..	L. C. Colyer ..	Goroke
469	Rantin Robin ..	A	,, ..	D. Clark ..	Bundalong South
364	Reality Rex ..	A	Pony ..	J. Archibald ..	Lockington
265	Referee	A	Draught ..	W. T. Manifold	Weerite
430	Reform	A	Light ..	J. Branson ..	Lake Cooper
365	Regis	A	Draught ..	E. Manifold ..	Camperdown
363	Relight	A	Light ..	D. Cameron ..	Newham
386	Rhymney II. ..	A	Pony ..	G. Roberts ..	Tarrington
362	Ribbon Bells ..	A	Light ..	Beattie Bros. ..	Tungamah
361	Rifle Boy	A	Pony ..	P. R. Cooke ..	Euroa
360	Rimfire	A	,, ..	Lucas Bros. ..	Carlisle River
326	Rising Star ..	3	Draught ..	E. Pearse ..	Rupanyup
358	Robin Gray ..	A	Pony ..	T. H. Phiddian ..	Goon Nure
357	,, Roy ..	A	Light ..	C. Paulin ..	Port Melbourne
334	Rob Shanter	A	Pony ..	Boyd Bros. ..	Tarrone, Koroit
316	Rocket	A	,, ..	A. W. Thomson	Hamilton
231	Roseberry ..	5	Light ..	G. Nuckie ..	Springhurst
420	Roseneath Clansman	3	Draught ..	W. Wilkinson ..	Tungamah
232	Roseworthy ..	4	Light ..	C. S. Walker ..	Swan Hill
447	Roy	6	Pony ..	R. P. Kennedy ..	Bass
102	Royal Belmont ..	A	Draught ..	Goss Bros. ..	Donnybrook
356	,, Ben ..	A	,, ..	J. M. Hamilton	Inverleigh
359	,, Blend (Robin)	A	,, ..	Thos. Long ..	Nhill
355	,, Crown ..	A	,, ..	W. Church ..	Katandra Nth.
354	,, Douglas ..	A	,, ..	T. Thornton ..	Waaia
353	,, Escort ..	A	,, ..	Hooper Bros. ..	Devenish
352	,, Fashion ..	A	,, ..	Ed. Cuthbert ..	Camperdown
236	,, Fashion ..	3	,, ..	T. J. Opie ..	Deer Park
448	,, Mint ..	A	Light ..	L. A. Harper ..	Rutherglen
307	,, Robin ..	A	Draught ..	J. Boyle ..	Boort
237	,, Salute ..	A	,, ..	T. Opie ..	Deer Park
306	,, Saxon ..	A	,, ..	J. M. Hunter ..	East Kew
327	,, Scott ..	A	,, ..	D. Golding ..	Cocamba
385	,, Shepherd ..	A	,, ..	Jas. McBean ..	Salt Lakes
393	,, Sovereign ..	A	Light ..	Chas. Ridley ..	Northcote
304	,, Style ..	6	Draught ..	McQueen Bros. ..	Waubra
305	,, Willie ..	A	,, ..	K. Cameron ..	Warracknabeal
303	Rufus	A	Thoroughbred	L. J. Weatherly	Mortlake
429	Sahara	5	Pony ..	E. A. Mahar ..	Kerang
302	Salient	A	,, ..	L. J. Weatherly	Mortlake

STALLION REGISTER, 1921–22—*continued.*

Cert. No.	Name.	Age	Class.	Owner.	Address.
		Yrs.			
289	Santrel	6	Light ..	R. W. Storey ..	Murchison East
436	Satellite Junior ..	A	Pony ..	W. Church ..	Katandra North
452	Scotland's Peer ..	6	Draught ..	D. Gardner ..	Milawa
301	„ Viceroy	A	„ ..	Walden Breeders' Club	Sheep Hills
238	Scottish Premier ..	3	„ ..	G. Burrows ..	Melbourne
300	Sea Lion	A	„ ..	W. Studman ..	Lucknow
5	Seldom	A	Light ..	J. Edes ..	Kensington
17	Selkirk	A	Draught ..	T. T. Mulder ..	Murroon
299	Seymour	A	„ ..	J. Cleeland ..	Bass
330	Shandon Bells ..	A	Light ..	W. Morris ..	Newmarket
298	Shepherd Plaid ..	A	Draught ..	E. Parish ..	Horsham
239	„ Premier ..	3	„ ..	G. Burrows ..	Melbourne
329	Silver Bells ..	A	Light ..	T. Coonerty ..	Yarragon
297	„ Cup ..	A	Draught ..	J. McLeod ..	Tongala
288	Silverlight	A	Pony ..	R. J. Jarvis ..	Cudgewa
261	Silverton	A	„ ..	J. Rogers ..	Allansford
332	Sir Burnhead ..	A	Draught ..	Boyd Bros. ..	Koroit
260	„ Don Pedro ..	A	„ ..	J. McKee ..	Clarendon
432	„ Douglas Haig ..	A	„ ..	Mrs. J. Biddlecombe	Shelford
240	„ Fabric ..	4	„ ..	G. Burrows ..	Melbourne
186	„ Goulding ..	A	Pony ..	S. T. Rash ..	Ballarat South
259	„ Joseph	A	„ ..	H. F. J. Lovett ..	Corowa
258	„ Mac	A	Draught ..	A. J. Donaldson	Harston
422	„ Marcellus ..	3	„ ..	Walder and Sons	Watchem
439	„ Onward ..	A	„ ..	W. Guymer ..	Katamatite
257	„ Regulus ..	A	„ ..	J. B. Howe ..	Bridgewater
26	„ Walter MacGregor	4	„ ..	J. Nulty ..	Walpeup
450	„ Wilfred ..	A	„ ..	A. J. Mackay ..	Coonooer Bridge
218	„ William ..	3	„ ..	McQueen Bros. ..	Waubra
256	Skipper	A	Pony ..	G. Hicks ..	Strathallan
255	Skobeloff	A	Thoroughbred	A. Thomson ..	Lismore
254	Southern Star ..	A	Draught ..	L. Curran ..	Cannie
150	Springbank Lawrence	6	„ ..	W. H. Crawford	Hamilton
253	Springwood ..	A	Light ..	G. J. Vagg ..	Cobden
153	Standard Bearer ..	A	Draught ..	J. R. Stokes ..	Ballarat
392	Star of Albyn ..	3	„ ..	F. H. Baker ..	Jung
252	Stern Anchor ..	A	Thoroughbred	R. J. McConachy	Wensleydale
251	Stickup	A	„	A. and J. H. Young	Blackheath
457	Stivious	2	Light ..	A. W. Lackman	Murrayville
445	Stockman ..	A	Draught ..	C. H. Perkins ..	Rainbow
350	St. Swivan ..	A	Light ..	S. Raine ..	Bendigo
250	Style O	6	„ ..	Wm. Barry ..	Heathcote
290	Superior	A	„ ..	D. Tallent ..	Underbool
2	Sweet Abbey ..	A	„ ..	R. Clulow ..	Nth. Melbourne
249	Taxpayer	A	Pony ..	R. Jamieson ..	Darlington
248	The Abbot ..	A	Light ..	A. B. Hamilton	Fish Creek
247	„ Bard	A	Draught ..	L. J. Weatherly	Mortlake
347	„ Factor ..	A	„ ..	C. Bates ..	Dobie
246	„ General ..	6	Light ..	D. J. Kendall ..	Cathcart
472	„ Knight ..	A	Draught ..	W. G. Pharoah ..	Warragul
245	„ Pedestrian ..	A	Light ..	Chas. Loft ..	Newport
479	„ Retainer ..	A	„ ..	R. A. Martin ..	Navarre
244	„ Starling ..	A	„ ..	S. Farrell ..	Stratford
470	„ Warrior ..	A	Pony ..	E. McKoy ..	Wodonga
243	Tim Brigham ..	A	„ ..	J. C. Nicoll ..	Euroa

Stallion Register, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
464	Titanic	A	Pony	J. E. Mark	Echuca
317	Toby	A	„	A. W. Thompson	Hamilton
242	Togo	A	Draught	H. Currie	Joel Joel
331	Tommy	A	Pony	Boyd Bros.	Koroit
423	„ Burns	3	Draught	W. Cook	Speed
424	Tom Thumb	A	Pony	W. F. Eichler	Chillingollah
323	„ Walton	A	Draught	F. W. Sallman	Dimboola
215	Tony	A	Pony	D. J. Kennedy	Cobram
214	Torfrid	A	Thoroughbred	D. Rogers	Boolara
213	Toy Bells	A	Light	A. Lumsden	Buninyong
103	Tracey Boy	A	„	Turner Bros.	Mernda
319	Trafalgar	A	Thoroughbred	Executors W. E. Mitchell	Corryong
322	Tramore	A	„	McDonald Bros	Mortlake
351	Trelawney Again	6	Draught	Dyke Bros.	Gre Gre Village
442	Tresco	A	Light	A. E. Bowman	Ebden
210	True Steel	A	Pony	Letcher Bros.	Avon Plains
318	Trump	A	„	A. W. Thompson	Hamilton
209	Union	A	„	J. C. Hulm	Terang
208	Valmond	A	Light	T. S. Hynes	Yendon
206	Vanguard	A	Draught	G. and W. Lorq	Rosedale
397	Vanquisher	A	„	J. Meagher	Murrayville
207	„	A	„	G. Clark	Wensleydale
425	Viking of Methven	A	Pony	Mrs. McLellan	Windsor
205	Wee Jim	A	„	J. R. Kettyle	Castlemaine
204	Welsh Flyer	A	„	F. Irving	Tyrrell Downs
443	Weralte	A	„	A. E. Bowman	Ebden
203	What Oh	A	„	W. Willmot	Berwick
431	What's Wanted	A	„	G. T. Brown	Officer
227	Widgiewa Chief	2	Draught	Gerrang Bros.	Mangalore
426	„ Ivo	3	„	W. G. Wilkinson	Tungamah
202	Wigton Again	A	„	R. Tenison	Lockhart, N.S.W.
427	Willie Wilks	A	Light	Rohan Bros.	Burramine East
459	Wiltshire	A	„	C. Wood	Minyip
201	Windlesham	A	Thoroughbred	J. Ferguson	Sth. Melbourne
105	Winsome Chief	5	Draught	Peter Rogers	Dimboola
200	Winteriga	A	Thoroughbred	J. D. Forsyth and W. Coe	Coleraine
199	Winter Wild	A	Light	G. T. Moyle	Harrow
325	Wizard Junior	A	Pony	J. A. Goodwin	Wunghnu
198	Wonga	A	Light	E. Parish	Horsham
388	Woodland's Beauty	4	Pony	E. Fulton	„
453	„ Dandy	A	„	W. A. McLean	Jung
14	Wotan	A	Thoroughbred	Dickinson Bros	Sebastopol
197	Yarrawaak	A	Light	F. D. McDonald	Terang
196	Yeneda	A	Thoroughbred	D. A. Hutchinson	Yan Yean
310	Young Badaween	A	Pony	W. Shaw	St. Arnaud
478	„ Brigham	A	„	J. H. Hindhaugh	Weerite
195	„ Coronation	A	Draught	W. J. Bennett	Cannie
291	„ Croydon	A	„	F. Town	Boort
194	„ Cymro Bach	A	Pony	S. J. Douglas	Stuart's Mill
467	„ Dandy's Pride	A	„	J. W. Powell	Beeac
292	„ Dundonald	A	Draught	W. Williamson	Whorouly
473	„ Estell	A	Pony	R. J. Falla	Donald
154	„ Flashlight	A	Draught	J. J. Norman	Bairnsdale
264	„ Ginger	A	Pony	W. T. Manifold	Weerite
466	„ Gladiator	A	Draught	Ross Bros.	Iona

Stallion Register, 1921–22—*continued.*

Cert. No.	Name.	Age.	Class.	Owner.	Address.
		Yrs.			
321	Young Hamilton ..	A	Draught ..	Arnold Bros. ..	Rupanyup Nth.
193	„ Hero ..	A	„ ..	S. J. Taylor ..	Lake Boga
465	„ „ ..	A	Pony ..	F. W. Hender ..	Franklinford
192	„ Lowrie ..	A	„ ..	K. McPherson ..	Broadford
191	„ McLeish ..	A	Draught ..	J. Charlton ..	Stony Creek
434	„ Middlemarch	A	„ ..	J. McKenzie ..	Dimboola East
190	„ Patrician ..	A	„ ..	F. E. Southwell..	Linga
328	„ Robin ..	3	„ ..	Coe Bros. ..	Coleraine
428	„ Sportsman ..	3	„ ..	Wm. Reid ..	Birchip
189	„ Sunbeam ..	A	Pony ..	J. M. Ferris ..	Terrick Terrick

The automobile, the drill, the threshing machine, the oil engine, electric driven machinery, all are the result of constant changes brought about by divine inspired dissatisfaction, by the ever-present, constant pressure for improvement which seems to be a component part in the make up of all.

The pure-bred cow has a like origin. For years and years some few men, gradually increasing in numbers and ability, have sought successfully, and unsuccessfully too, sometimes, to improve the economic productivity of the dairy animal. While the engineer has been measuring in meters and centimeters, the cowman has been measuring in pounds and ounces. While the engineer has used the electric crane and electric magnet, the cowman has used the Babcock test and scale, whose lifting power has proved of inestimable value in improving the yield and decreasing the cost of dairy products.

Can we not see that it is as much to our interest to use good dairy blood as it is to use those other time-saving and labour-reducing machines?

If we milk what one authority calls "female steers," cows, whose natural instinct to give milk at all seems almost lost, cows fed without regard to economy or efficiency, we can hardly expect to have the consuming public tamely submit to payment of prices to cover such methods. Further, we surely have not the face to ask it. Lower prices ought to stimulate economical production.—*South African Dairyman.*

AUSTRALIAN SALT-BUSH IN SOUTH AFRICA.

Co-operative experiments, conducted by the Government Agronomist with the aid of farmers over a number of years, have shown the merits of the undermentioned Australian varieties of salt-bush:—

(*a*) *Atriplex nummularia,* Lindl. (Round-leaved or Old Man Salt-bush);

(*b*) *Atriplex semibaccata,* R. B. (Half-berried or Creeping Salt-bush);

(*c*) *Atriplex halimoides,* Lindl. (Halimus-like or the Grey Salt-bush);

(*d*) *Atriplex leptocarpa;*

(*e*) *Atriplex holocarpa,* F. v. M. (All-fruited Salt-bush);

(*f*) *Atriplex visicarium;*

(*g*) *Atriplex angulata,* Benth (Angular-fruited Salt-bush);

in regard to which the following points are noted:—

(*a*) A perennial, erect shrub; resists drought to a remarkable degree, reaching a height of 5 to 8 feet in four years, and grows on very brack soils.

(*b*) Habit of growth is prostrate and branching, forming a dense growth on the surface of the land. Also grows on soils too alkaline to support any other form of cultivated plants. It is a perennial, but some farmers are of opinion that it should be treated as an annual in districts where the winter is exceptionally severe.

(*c*) A low bush creeping along the ground, described by some as a perennial and by others as an annual; dependent presumably on the winter temperature. It is recommended to sow this variety in the spring.

(*d*), (*e*), (*f*), (*g*) These varieties are, more or less, annuals, and although they make excellent stock feed, farmers prefer the perennials. The Holocarpa (*e*) is highly recommended by some farmers for land liable to be flooded.

All salt-bushes prefer moist brackish land; but are able to accommodate themselves to a great variety of conditions. Seed may be sown at any time during the spring or summer months when the soil is moist.

Manner of Planting.—Some people loosen the soil with a spade or a hoe in patches some little distance apart, and six to twelve seeds are planted in each plot, according to the size of the patch. Others plough the ground and harrow the seed in. The bush will naturally spread much faster on properly tilled land. The quantity of seed required will vary with the distance apart of the patches or rows, as the case may be. About 20,000 seeds go to the lb., so that ten seeds

every 2 yards means only 1⅓ lb. per morgen, while at 10 yards apart about ½ lb. per morgen will be required. Various methods of planting salt-bush seed are employed by farmers, and 1¼ to 1½ lb. is generally used per morgen, or half that amount per acre. The seed is covered from ¼ to ½ inch deep (the shallower the better), and young plants must be protected from the too-assiduous attention of live stock. When once well established salt-bushes require very little care, beyond being occasionally protected so as to permit them to flower and resow themselves. The Australian salt-bushes seem to possess a more vigorous growth and seed more freely than our own, although some farmers speak very highly of our *Atriplex capensis* (Cape salt-bush) and claim that it is more drought-resistant than any of the exotic species. Salt-bush will also grow from cuttings, but this is a somewhat slow method. —*Journal of the Department of Agriculture,* Union of South Africa, January, 1921.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Cultivation.

Orchard ploughing should now be finished, and the main work for the next few months will be an endeavour to keep the soil surface loose, friable, and well opened. The consolidation of the surfaces must be avoided, as a hard, compact surface means the loss of much soil moisture, by capillary attraction. So that after rains, heavy dews, the spray pump and other traffic, it will be as well to run the harrows over the surface of the soil, so as to keep the surface well broken and to maintain a good earth mulch. If the harrows are not sufficient to break the clods, a spiked or heavy roller should be drawn over it, and then harrowed. If the weather is at all dry it is advisable to plough only as much as may be harrowed in the same day. By immediately following up the ploughing with harrowing a minimum amount of moisture is lost by capillarity.

Green manure crops should now be ploughed under, and should they be very abundant in growth, a roller should be run over them and ploughed with a coulter attached. Any of these means will serve to get the crop underground, which is a desideratum.

In addition to the retention of soil moisture, cultivation of the orchards will suppress the weeds which rob the trees of food and moisture. The suppression of weeds is an important work in the spring and summer, and they should be rigorously hoed or cultivated out.

Spraying.

Spraying for all pests and diseases is, at this time of the year, an important work in the orchard. Bordeaux or lime sulphur spraying for the black spot of apples and pears, for scab and shothole in peaches and apricots, for the leaf curl of the peach and rust of the plums and peaches, should now be completed.

Where there are indications that previous sprayings have not been thoroughly successful, a weak lime sulphur spray should be given.

Wherever they are present, nicotine sprays should be given to combat the peach aphis, and the pear and cherry slug. For the latter pest, arsenate of lead should not be used if the cherries are within a month of ripening. Arsenate of lead is so tenacious, and thus it is likely to remain on the fruit until it is ripe, when it would be dangerous to the consumer. Thus, while this property of remaining on the fruit for a considerable time is of great value in the Codlin Moth spraying, it is quite of the opposite value when used for the pear and cherry slug. Either tobacco water or hellebore is useful for the eradication of this pest, as these substances do not remain long on the trees, and they are quite as effective as arsenate of lead. Even a dry dusting with lime or with ordinary soil will keep the slugs in check.

Codling moth spraying, too, will be in evidence this month. It is generally assumed that the appearance of the moth is coincident with the bursting of the flowers. This is not always so—the moths frequently come slightly later than the blooming period. Owing to the rapid expansion of the fruit, it is well to follow the first spraying with a second in a week or ten days' time. Arsenate of lead is still the spray for the Codlin moth, nothing having been found to supersede it.

Arsenate of lead may be mixed with nicotine sprays, or with Bordeaux mixture, without any detriment to either spray, if necessary.

The Vegetable Garden.

A good tilth, and a well-pulverized soil, are the main soil necessities in the vegetable garden this month. Frequent cultivations will keep in the soil moisture, and will obviate the necessity for surface waterings. At the same time, it should be remembered that the vegetable garden requires more water than the flower garden, owing to the quick growth of the plants. Quickly-grown vegetables are more tender and more luscious than slowly-grown ones: thus a good water supply will need to be maintained. Weeds are great moisture-robbers, and they should be kept out of the vegetable garden at this time of the year.

Late plantings of tomatoes may now be carried out; all early-planted plants should be fed, staked, and the laterals pinched back. A little bone-dust or superphosphate may be given, but these are not equal to animal manures, if the latter are available. Chemical manures should only be given in limited quantities, 6 or 7 cwt. per acre would be a heavy dressing, and this works out at nearly 3 ozs. per square yard.

Vegetable growers may easily try this for themselves, and it will soon be seen that 3 ozs. scattered over a square yard of surface will appear to be a very light dressing.

French beans, carrot, parsnip, celery, radish, peas, and turnip seeds may now be sown. Seeds of cucumber, melon, and pumpkin family may now be sown in the open ground. All seedlings may be transplanted on favorable days, and it will be well to sprinkle the tops as well as to water the roots.

Asparagus beds may be top-dressed with manure, and kept well weeded. Such weak growths that are not gathered for eating should be cut out of the beds.

The Flower Garden.

Flower gardens are troubled with many pests at this time of the year. Rose aphis is one of the most prevalent; frequent applications of tobacco water will keep this pest in check. The hot winds should not be waited for so as to rid the garden of the pests, because a great deal of damage is done before the hot winds come. They should be sprayed in any case.

Rose mildew will also need combating. This may be done by dusting the bushes with sulphur while they are wet with the morning dew. The ground may also be sprinkled, as the fumes check the fungus.

The latest American remedy is to dust the bushes with one part of dry arsenate of lead to nine parts of sulphur. This is also a remedy for black spot of roses.

Leaf-rolling or leaf-eating insects will need to be sprayed with arsenate of lead or Paris green.

The surface should be kept well hoed so as to conserve the moisture, especially after the frequent waterings that should be given.

Chrysanthemums may be planted in soil that has been dug over two or three times, and each time digging in manure. The soil must not be too rich, but must be well drained.

Bulbs that have lost their foliage may be lifted, but do not cut the foliage, as this means loss of sap and energy.

Asters, zinnias, salvias, balsams, amaranthus, celosias, &c., lobelia, bedding begonia, iresines, alternantheras, &c., may now be planted out for summer and autumn flowers.

REMINDERS FOR NOVEMBER.

LIVE STOCK.

HORSES.—Continue to feed stable horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old and badly-conditioned horses liberally. If too fat, mares due to foal should be put on poorer pasture. Turn out workers due for a spell at grass. In

view of sand trouble this year horses which have been paddocked all the winter should not be put to work until properly conditioned and any sand accumulation got rid of. A course of three or four bran mashes, after a twelve hours' fast, followed by 1 to 1½ pints of linseed oil, is helpful. Repeat in two or three days, if necessary. Colts to be gelded should be operated on before hot weather sets in.

Cattle.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw, if possible, to counteract the effect of green grass. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a dry shed and a good grass run. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Feed regularly with regard to quantity and time. Give a cup of limewater in the milk to each calf, also place crushed oats or lucerne hay in a trough so that they can eat at will.

Pigs.—Supply plenty of bedding in well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Sows suckling young should be well fed to enable them to produce plenty of milk. Give young pigs pollard and skim milk in separate trough as soon as they will take it, and keep them fattening from the start to get them off as early as possible. Give a tablespoonful of bone meal, or half that amount of mineral phosphate per 100 lbs. live weight in food daily. If pigs are lousy dress them with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect styes. Pig breeding and feeding should be very profitable for a long time to come, and it should be safe to launch out now.

Sheep.—Prepare for dipping. Ascertain exact contents of bath before mixing. Powder or paste dips have the most lasting effect, particularly where lice have been bad. Hold sheep in the bath not less than half a minute; if badly infested, longer. Submerge heads twice, but allow them to rise quickly—most deaths after dipping are due to gross carelessness in holding sheep under too long, the dip wash being taken in on to the lungs. Dip rams and full grown sheep first, while bath is full, lambs last. Yard sheep over night. Dip while empty, and avoid fouling the drainer. Commence early in the day, and allow sheep to dry before nightfall. Avoid travelling long distances to and from baths, and dipping sheep while overheated. Do not roughly throw sheep in. Avoid filthy baths; this increases a dead tip in hot areas.

It is unsafe, and against instructions, to use powder dips in increased strength. Sheep badly lice-infested should be dipped directly off shears, and again in six weeks' time. Sheep with over a reasonable amount of wool on should be dipped at less strength than given on instructions. Close, fine-wooled sheep particularly so.

When constructing new dips, remember moderate-sized ones are most economical, just as efficient, and can be more easily emptied as they become fouled, and if they are near water can be quickly filled.

Poultry.—Provide plenty of green food and shade. Watch for vermin; spray crevices of perches and houses with crude carbolic acid, 1 in 50. Keep water clean and cool, and out of the sun. One packet of Epsom salts should be given to thirty birds through the mash. Remove all male birds from the flock. Infertile eggs are preferable when pickling, or when placed in cool storage.

CULTIVATION.

Farm.—Plant main crop of potatoes. Cut hay and silage. Weed early potatoes. Sow maize and millets. Weed tobacco beds, and water, if dry.

Orchard.—Ploughing, harrowing, and cultivating to be continued. Weeds to be kept down. Secure, pinch, and spray grafts with water. Spray frequently for codlin moth, pear and cherry slug, and peach aphis. Plant out citrus trees.

Vegetable Garden.—Hoe and mulch surface. Suppress weeds. Water where dry and hoe afterwards. Disbud and pinch back tomato plants. Sow French beans, peas, lettuce, cucumber, melon, &c., seeds.

Flower Garden.—Water and mulch. Cultivate and keep down weeds. Thin out weak wood from roses. Prune early all flowering shrubs that have finished flowering. Lift and store bulbs. Plant out chrysanthemums. Liquid-manure herbaceous perennials. Sulphur-dust for rose mildew.

Vineyard.—Field grafts require careful attention in the way of removal of suckers and scion roots. (See Bulletin on "Spring Grafting," No. 38, page 29.) Keep a sharp look out for Downy Mildew; whether the disease is seen or not, finish spraying by 20th October. A preliminary spray when the bunches are most visible is strongly recommended. In irrigated vineyards make it a rule to *spray immediately before watering.* Information on "Mildew and its Treatment," will be posted on application. Cultural work, such as scarifying and hoeing, should be actively pushed forward, so as to provide as good a "mulch" as possible during summer. Proceed with tying up, stopping and topping. Avoid excessive topping, summer pruning being usually more injurious than useful in warm, dry climates. Cincture Zante currant vines after flower caps have fallen. Apply second sulphuring just before blossoming, wherever Oidium was prevalent last year.

Cellar.—Taste all young wines; beware of dangerous symptoms in unfortified fruity wines, which may need treatment. Fill up regularly all unfortified wines.

BEE-KEEPING.

In most districts, October is the principal swarming month; in late localities, particularly at the higher elevations, most of the swarming takes place in November. Where a honey flow is expected from Redgum during December and January, it is not wise to make a further increase in the number of colonies by allowing after-swarms to come off and hiving separately, as the parent stock would be too much depleted of bees, and there would not be sufficient time for it to recover, or for the swarms to build up, before the honey flow is on, and much of it would therefore be lost.

After-swarms can best be prevented by hiving the first or prime swarm on the old stand and moving the colony from which it came to a new stand, at the same time destroying all the queen cells in it except one—the most perfect and forward one.

If no increase at all is desired, the parent colony may be left alongside the old stand on which the swarm was hived, but with the entrance facing in a different direction. When the young queen in the swarmed stock is laying, which will be in about three weeks, the hive may be gradually turned round till it faces the same way as the swarm, and, after removing the old queen from the swarm, the two stocks may be re-united, thus making a very strong colony with a young laying queen, in the best condition for storing honey and very unlikely to swarm again the same season.

As in most localities the colonies have come through the Winter very strong, there is likely to be much swarming wherever Cape Weed or some other pollen-yielding plant is plentiful, the duration of blooming depending, of course, upon the weather.

When several days of bad weather follow the hiving of swarms, it may be advisable to feed sugar syrup (one part sugar to one part water) to keep up comb-building and brood-rearing, so as to have the greatest number possible of field bees in the hive during the honey flow later on.

The Wonderful

SUDAN GRASS

The Greatest of all Summer Fodder Plants

Produces a higher yield of forage, under drought conditions, than any other Summer Plant.

Under average conditions it grows to a height of from 5 to 6 feet. Under good conditions it has been known to grow as high as 8 feet.

ADAPTABLE TO ALL CLIMATES AND WILL THRIVE ON ANY SOIL

The palatability of Sudan Grass cannot be questioned, as all classes of stock eat it readily, whilst judging from the way sheep fatten, cattle increase their milk flow, and horses work when fed on it, it must be exceedingly digestible, a quality that deserves consideration in feeding.

In the very hot, dry Summer periods it will always provide green succulent fodder when other grasses are absolutely dry.

WE HANDLE ONLY ONE GRADE OF SUDAN GRASS SEED—THE BEST REMACHINE-CLEANED, PURE, AND OF THE HIGHEST GERMINATION

Our Clients report splendid results from Seed supplied by us last year.

SOMNER'S "Tip-Top" Strain Sudan Grass, 1/- lb.; 84/- cwt.

Local—9d. lb.; 74/8 cwt. Special quote for large quantities

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Seed Merchants and Nurserymen

139-141 Swanston St., Melbourne

Booklet giving useful information on Sudan Grass Post Free on application

DEPARTMENT OF AGRICULTURE, VICTORIA

Red Poll Dairy Herd

The Department will shortly have completed the orders for the 56 bull calves that were booked ahead of calving when the advertisement was withdrawn; consequently the booking of orders for bull calves from the forthcoming spring calvings has now been resumed.

BULL CALVES are sold for delivery at a month old at prices based approximately on the actual milk and butter fat record of the dam at the rate of 1s. per lb. of butter ***fat*** yielded.

(See Record of Yields published annually in this Journal.)

The Bulls in Use include—

LONGFORD MAJOR (Imported)

Dam's Record 14713 lbs. milk ... 6 years average 11338 lbs. milk
G. Dam's ,, 10548 ,, ... 4 ,, ,, 9155 ,,

BELLIGERENT (Imported)

Dam's Record (1st milking) 7144 lbs. milk.

Dam's Dam's	,,	14533 lbs. milk	...	4 years average	12871 lbs. milk
Sire's Dam's	,,	10370 ,,	...	7 ,, ,,	9354 ,,
Sire's D. Dam's	,,	9510 ,,	...	12 ,, ,,	8033 ,,
G. Sire's D. Dam's	,,	10215 ,,	...	7 ,, ,,	9386 ,,
G.G. Sire's D. Dam's	,,	12565 ,,	...	10 ,, ,,	8853 ,,
G.G.G. Sire's D. Dam's	,,	10088 ,,	...	2 ,, ,,	9754 ,,

Inspection of the Herd is Invited.

Visitors will be met at the Station on notifying the Manager, State Research Farm, Werribee.

Application for purchase to

Dr. S. S. CAMERON, DIRECTOR OF AGRICULTURE, MELBOURNE.

DEPARTMENT OF AGRICULTURE, VICTORIA

Pure Ayrshire Bulls

for Sale

STATE FARM, RUTHERGLEN

Royal Prince of Gowrie Park

Colour, Brown and White. *Calved 30th July, 1915*

Bred by Mr. W. P. Brisbane, Gowrie Park, Weerite, Victoria.

Pedigree.

Sire: Wallace of Gowrie Park (675) A.H.B. of A.
Dam: Princess of Gowrie Park (1710) by Heather of Jock 2nd (387)
2nd Dam: Princess 4th of Luminous of Oakbank (456)
3rd Dam: Young Princess by Dahlia's Adonis (172)
4th Dam: Princess by Young Norman (225)
5th Dam: Fancy by Earl of Seafield (422)
6th Dam: Princess by Norval.

Princess of Gowrie Park yielded 8,930¼ lbs. milk with a 4·67 test in 273 days.

COLLEGE PRINCE

Colour, Brown and White. *Calved 24th September, 1917*

Bred by Department of Agriculture at the State Farm, Rutherglen.

Sire: Royal Prince of Gowrie Park by Wallace of Gowrie Park (675) A.H.B. of A.
Dam: Irene 2nd of Flinders by Glen Elgin's Combine.
2nd Dam: Irene of Flinders by Gleneira's Monsieur (546)
3rd Dam: Irene of Gleneira (1727) by Majestic of Oakbank (326)
4th Dam: Isabel of Gleneira (1036) by Red Chief (359)
5th Dam: Gaiety (1006) by Dainty Davie.
6th Dam: Princess (270) by Prince.

Irene 2nd of Flinders yielded 570 gallons of milk with a 4·2 test in 304 days.

Inspection of these Bulls at the State Farm, Rutherglen, is invited

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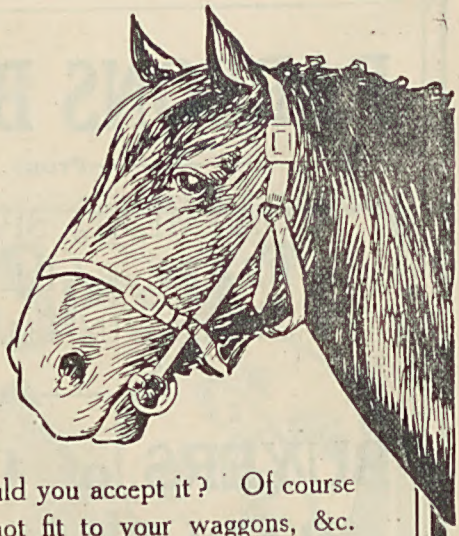

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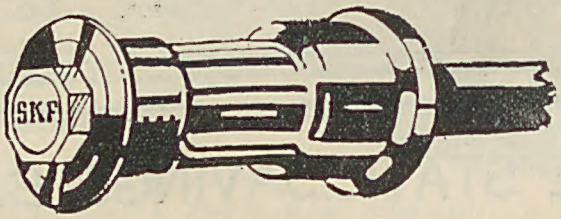

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